80 NEW PRODUCTS FOR THE MAC! *SEE PAGE 153*

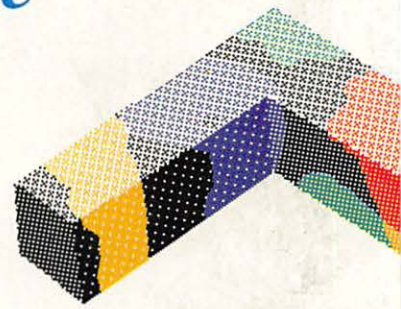
MACWORLD

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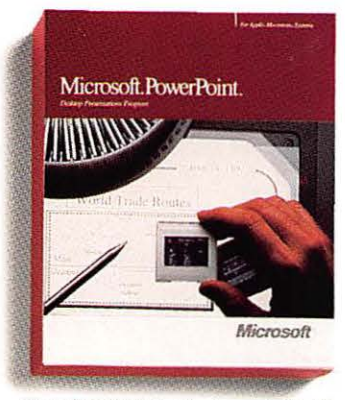
1988 Winners!

Computer Graphics on the Mac



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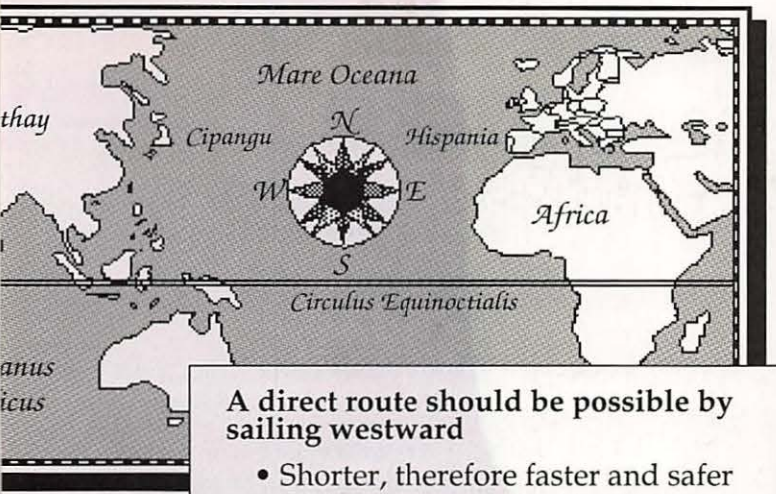
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A NEW TRADE ROUTE



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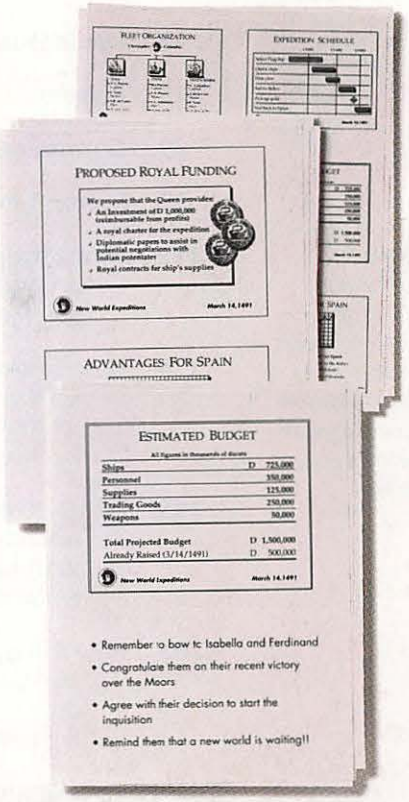
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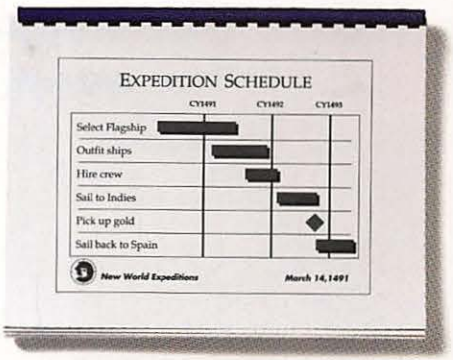
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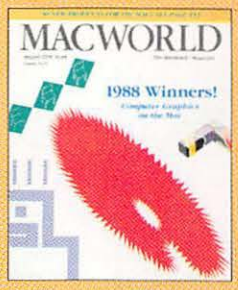


Your audience will flip over charts like this, created entirely with PowerPoint.

MACWORLD

August 1988

The Macintosh® Magazine



On the Cover
From the electronic drawing board: the Macintosh Masterpieces, award-winning works of art in Macworld's *first annual contest appear on page 74. (Cover art by John Hersey.)*

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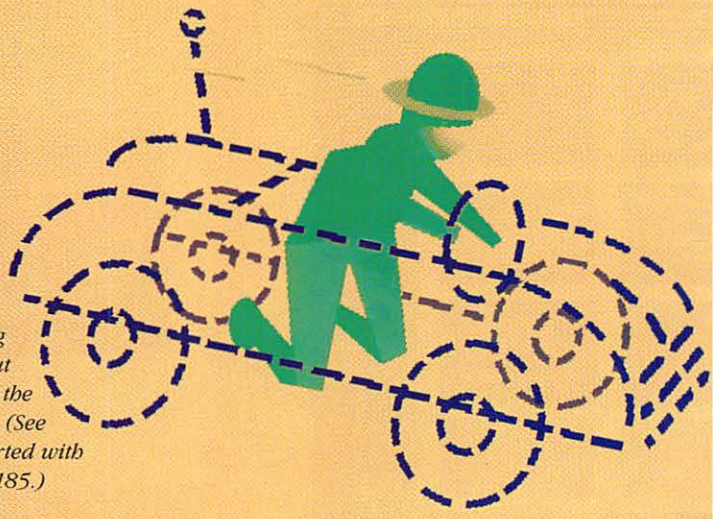
55 Macworld News

▪ *High-End CAD* AutoCAD for workstations comes to the Mac II.

▪ *Desktop Video* How the Mac produces video animation.

▪ *PowerPoint in Color* Color slides brighten Mac-based presentations.

Plus, putting 3-D models on screen, HyperCard as a report-producing database, experimenting with headline fonts, and more.



Mac drafting programs put designers in the driver's seat. (See "Getting Started with CAD," page 185.)

Dozens of dinos roam the wilds of a new HyperCard stack. (See page 57).

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For a close-up view of how to improve scanned photos 16 ways, see "Reality Transformed," page 82.

MACWORLD

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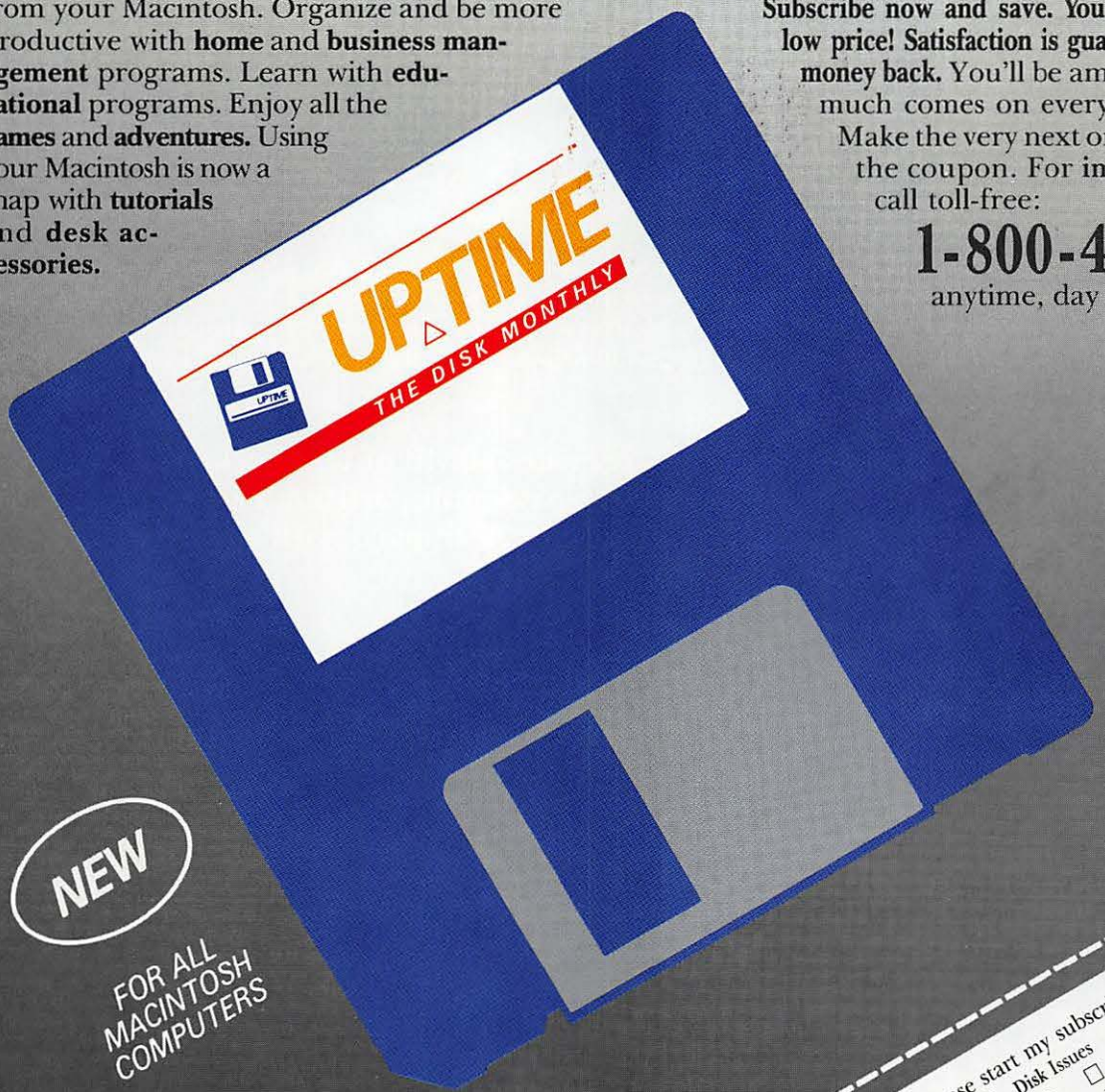
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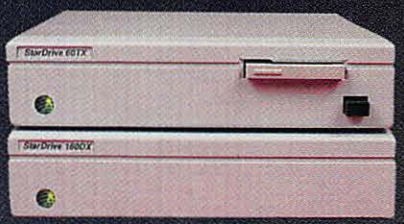
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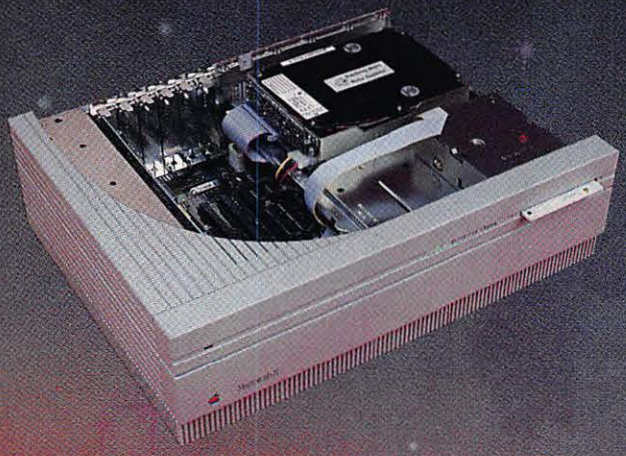




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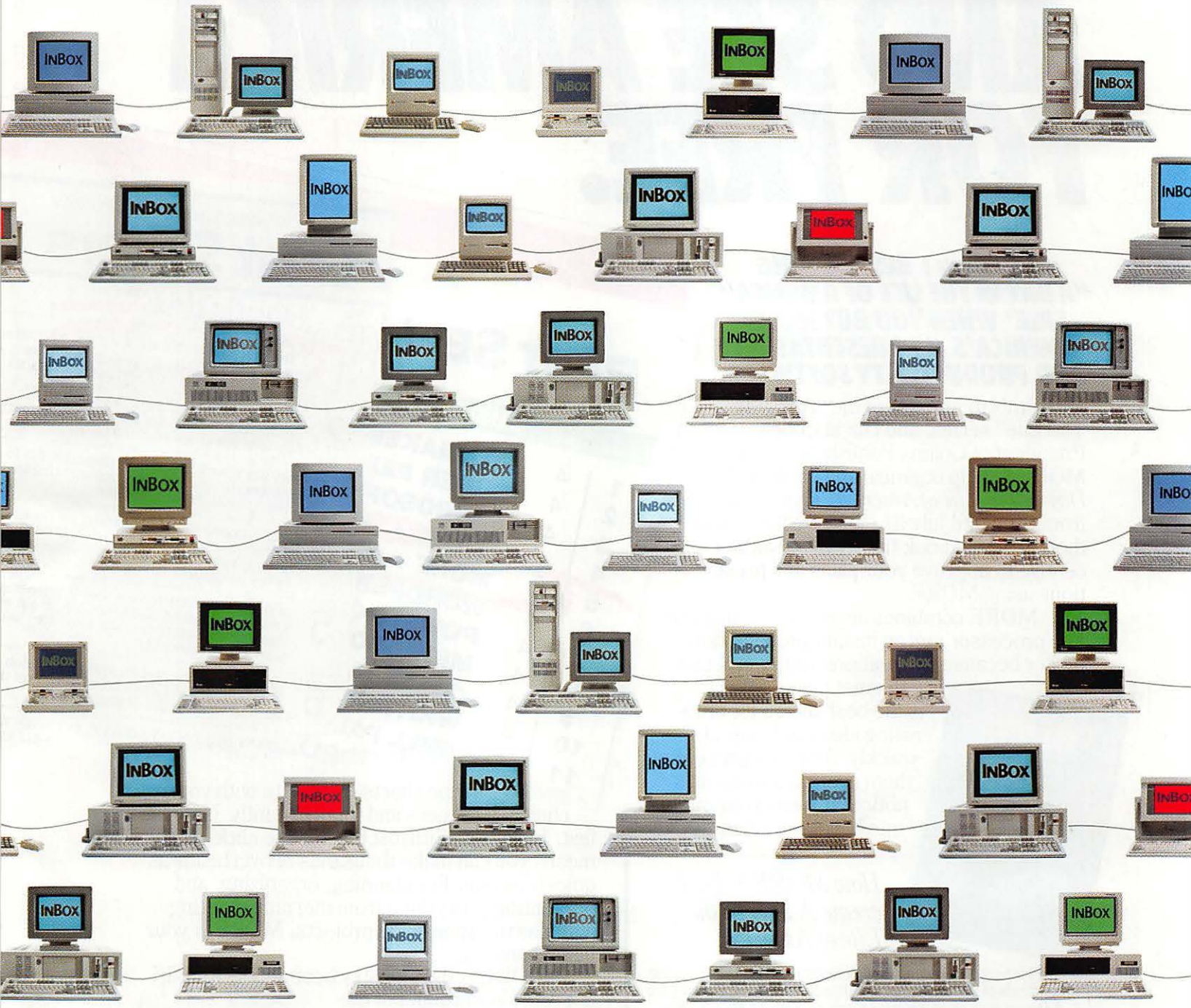
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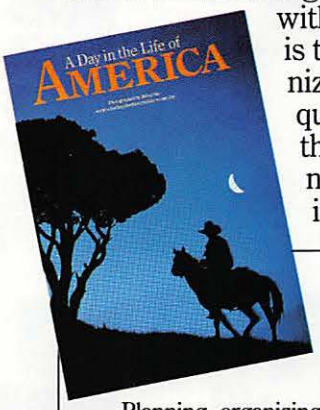
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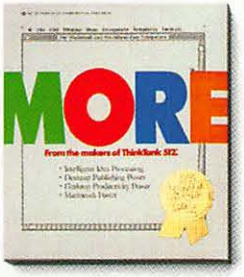


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Mac Bulletin

New AppleLink Service

Apple and Quantum Computer Services have announced a new online communication and information service called AppleLink–Personal Edition, an end-user version of Apple's developer/dealer–oriented AppleLink online service. The service will be available to Apple II owners this summer. (Macintosh users, however, will have to wait until later in 1988 for access.)

Personal Edition will offer both Apple-specific and general-information forums. Among the forums will be a direct connection to Apple Customer Relations, online chat sessions, third-party company technical support, a public domain and shareware library, and the online Apple University. General forums include special-interest groups, stock market information, news, the Comp-u-store online shopping mall, and American Airlines EAAsy Sabre service.

Suggested retail price for the package is $35, plus an annual subscription fee of $35 after the first year. Connect charges are $15 per hour for prime-time use (7 a.m. to 6 p.m. weekdays), and $6 per hour for non–prime-time use. To make accessing Personal Edition more affordable, Apple will lower the price of its Personal Modem by $120, to $279.

Saving Your Hard Disk

Many crashed hard disks still contain all their files and programs, but it has been impossible to access this information from their corrupted directories. Coming to the rescue is Symantec Utilities for the Mac (SUM). This utilities package contains a program called Guardian, which can often restore a crashed hard disk in less than a minute by building a desktop-style directory on the hard disk, and ideally on a floppy disk as well. But remember, this program must be used preemptively; it's intended to augment, not replace, backups.

Another major feature of Guardian is a virus-protection utility. While it cannot prevent a System from becoming infected, this utility informs you when a virus has invaded. The program prevents most crashes by blocking illegal System calls. Other SUM features are disk optimization, hard-disk partitioning with encryption, and rescuing of deleted files.

SUM's list price is $99.95. With the first 5000 copies sold, purchasers can obtain an additional program free—either HFS Navigator or LaserSpeed, a print spooler. For further information, call Symantec at 408/253-9600.

Illustrator 88 Ships

Adobe's long-awaited Illustrator 88 drawing program includes a number of features not originally intended for the color graphics product, such as freehand drawing, automatic tracing of bitmapped images, masking, blending, and easier creation of resolution-independent fill patterns.

List price of the major upgrade is $495. It's available free to those who purchased Illustrator after January 1, 1988, and for $100 to all other owners.

Spot Inking for Brighter Images

Four-color ribbons can be costly, especially when one band wears out long before the others do. Now there's a solution: Multicolor Mac Inker from Computer Friends.

With this inker you can reapply ink to any of the four bands either singly or in combination. According to Computer Friends, reinking costs only five or six cents per application, compared with buying a new multicolor cartridge that costs $9 to $25 depending on the printer and manufacturer. Another plus: freshly applied inks often yield brighter images.

Impressive Printing

One way to substantially improve the appearance of laser printer output is with specially designed paper such as Laseredge from CG Graphic Arts in New York (212/925-5332). It increases clarity by providing a flat, smooth surface for deposited toner—no longer does toner drop down into the valleys of duplicator paper, which has a much rougher surface. Laseredge is available in a wide range of weights and in films.

There's also a new product for the ImageWriter II that, while not improving print quality, will certainly make tractor-fed paper handling more convenient. This $49.95 paper stand from Stay/Up (602/966-6886) automatically refolds tractor-fed paper as it comes out of the ImageWriter.

Horsepower for A/UX

Golden Triangle Computers has announced a 25-MHz, 68020-based coprocessor board, called FirePower, for Mac IIs running under the A/UX operating system. FirePower is not an accelerator that replaces the II's CPU; rather, FirePower runs in conjunction with the CPU as an application coprocessor for computation-intensive A/UX tasks.

For example, users can off-load certain processor-intensive tasks to FirePower and thereby prevent tying up the Mac II system. If FirePower's Mac II host is on an Ethernet network, any other network node can access that FirePower board, providing that the node supports TCP/IP protocols. One Mac II can host up to five FirePower boards.

The board includes 1 megabyte of ROM, two Appletalk-compatible serial ports, and one high-speed SCSI interface that's said to be four to ten times faster than the Mac

(continues)

II's built-in SCSI interface. A 25-MHz, 68881 math coprocessor chip and up to 4MB of memory are optional. Prices for FirePower start at $3000. For more information, contact Golden Triangle Computers at 619/279-2100.

World Markets Await

Travel to a foreign country and you might be amazed to see your favorite program working in any one of 17 languages, including Japanese and Arabic. That's because it's relatively easy to "internationalize" Mac software: all of the language components—the menus and dialog boxes—are kept in separate modules that are quickly modifiable.

Apple is urging software developers to take advantage of its new Global Software Information evangelism program, which offers a new technical design manual, marketing information, and access to 27 versions of the Mac operating system (also available through the Apple Programmer's and Developer's Association).

An example of the growing internationalization of Macintosh markets is Rav-Ktav, a Hebrew/English word processor, and MacKtav, a Hebrew/English desktop publishing program, with list prices of $350 and $595, respectively, from Davka Corporation (800/621-8227).

Changes for SE and Plus

By fall, you can expect to see the elimination of differences between the European and U.S. versions of the SE and Plus chassis. From a user perspective, the most visible change will be the elimination of a mounting bracket for plug-in cards on the SE. Previously, Apple spot-welded this bracket to the SE chassis. In the future, developers must provide this bracket—which costs about 20 cents—with each plug-in card. There should be few substantive differences for the Plus, which will continue with no fan and no slot for internal cards.

Extending the Reach

In setting up a LocalTalk network, large factories, office complexes, and college campuses can run up against LocalTalk's 3000-foot line-length limitation. That's why Farallon Computing is offering LineDriver, which amplifies LocalTalk signals so they can reach at least 6000 feet. LineDriver works well with Farallon's PhoneNet cabling system and management software and is compatible with FlashTalk. List price is $395. For further information, call Farallon at 415/849-2331.

New Mac II Newsletter

Macintosh II Report is a monthly newsletter focusing on information specific to the Mac II. Its first edition, which came out in April, features a description of differences between the Mac II, the SE, and the Plus. Also included is a list of programs that have problems running on the Mac II, information on internal hard disks, and the latest word on upgrades and bug fixes. A sample issue is available for $2; a year's subscription costs $48. Write to Macreations, 329 Horizon Way, Pacifica, CA 94044.

Full-Fledged AI

In March, Apple and Texas Instruments announced the microExplorer AI (artificial intelligence) workstation, based on a Mac II with a LISP coprocessor chip, that offered near-workstation-like performance at a greatly reduced price. All that was missing was the appropriate software.

Inference is filling this need by offering expert-system software called ART (Automated Reasoning Tool), which can be used to develop and implement AI applications that can combine with Macintosh programs. For instance, a Mac application that controls a manufacturing process can feed data to an ART program that sends decisions back to the Mac application for implementation. For further information, call Inference at 213/417-7997.

New CD ROM

Both Toshiba and NEC are bringing CD ROM drives to the Mac, thus competing with Apple's own $1199 Apple CD-SC, which has an average access time of 600 milliseconds. Toshiba's XM-2100A-Mac claims a significantly faster access time of 400 ms and sells for only $999. NEC's Intersect CDR-77 drive costs $1198 (including a $199 Mac-SCSI interface) and offers an average access time of 500 ms. All three units will support the High Sierra CD ROM and Mac HFS file formats.

One important extra, available only with NEC's drive, is a $399 CD ROM that includes 2500 3-D objects and fonts ready for importation to various graphics and publishing programs. Since the images are object-oriented, they can be edited, resized, and reshaped for many purposes.

A Science Cornucopia

Apple Engineering/Scientific Solutions Guide (Summer 1988), a 278-page publication that describes nearly 500 software and hardware products, is now available at Apple dealers for $6.95. This Apple-produced document also includes information about price, support, and how to contact manufacturers. Products are listed in the following categories: architecture, manufacturing planning/control, mapping/earth resources, scientific/laboratory, software development, and technical productivity.

Apple's First Network Manager

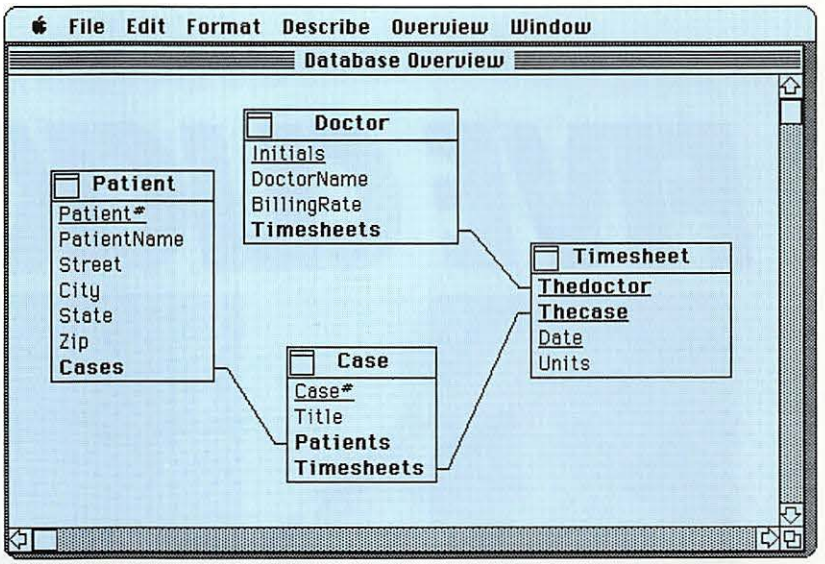
Apple now has its first network-management program for AppleTalk networks, InterPoll. With it, network administrators will be able to view the network number, node number, socket number, name, and device types of everyone on the network. The network can also be viewed on a zone-by-zone basis.

InterPoll can turn off the LaserWriter reinitialization dialog box. It can also determine if everyone on the network is operating with the same version of the System, Finder, and LaserWriter driver. InterPoll can send signals to any device on the network, determine where a break in the network has occurred, and determine whether all bridges are functioning properly. List price of InterPoll is $129. □

Reflex Plus can show you more about relationships than Dr. Ruth

The relationships between different pieces of data within your database are all important ones. Because Reflex Plus is truly *relational*, it can "relate" and cross-reference your data.

Many "database managers" are not much more than "list managers"—simple lists that can't connect and cross connect one item with another. So while they can "list," they can't really "manage."



You simply draw connecting lines to relate one item to another.

What your data tells you depends on how you look at it

It's easy to customize your output with Reflex Plus. Whatever you're working on—letters, invoices, quotations or data entry screens—Reflex Plus lets you add graphics, position them wherever you want, change sizes, change fonts and produce truly professional results. Reflex Plus lets you make the most of your Macintosh.

Some of the power pluses of Reflex Plus

- Visual database design—a "natural" for your Macintosh
- WYSIWYG ("What-you-see-is-what-you-get")
- Truly relational database manager
- Auto-Save—which means you'll never lose data again
- Paste Choice command that saves you enormous amounts of time
- Context-sensitive online Help
- Automatic creation of formulas to let you instantly search, sort, calculate, qualify and more
- Multiple entry forms for the same database
- Entry for more than one database in a single entry form
- Shows one record at a time or all records at once
- Calculated fields in entry forms
- Display-only fields
- Default, but editable fields
- GROUPBY function
- Record sizes can be 1000, 2000, or 4000 characters
- Compatible with all Macintoshes with at least 512K RAM including Macintosh SE and II
- New rewritten documentation

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BI 1204

"Borland's new relational database, Reflex Plus, is the best Macintosh database . . . It is simple to use and operate, very flexible in design, low cost (only $279 compared to $500 for dBase Mac), and small in size (250K versus 730K for Fourth Dimension) . . . We converted an Omnis 3 database that took two weeks to design into Reflex Plus in two days . . . We think Borland is right on target with their approach.

David Smith, MacTutor"

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Reflex Plus is the super-power of truly relational databases, and it's only $279 plus shipping and handling.



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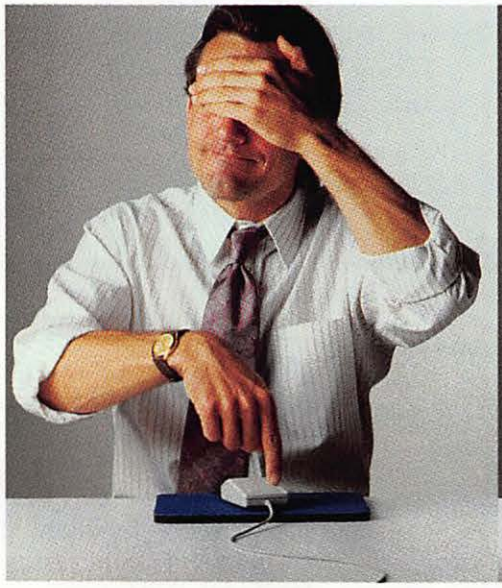
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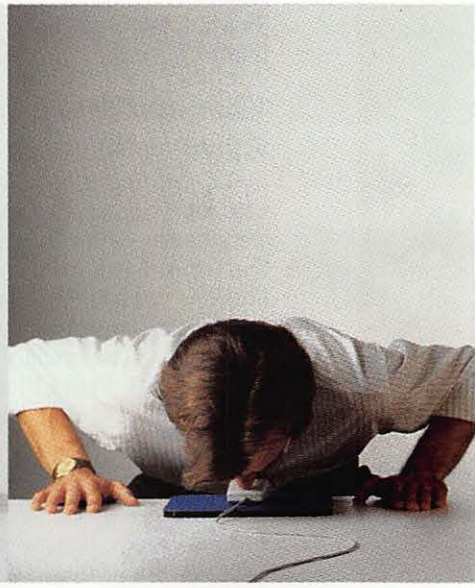
FIVE CLICKS TO SUPE



"...Folks, in all my years in broadcasting, I've never seen anything like it. Just look at the control."



"He's on the table. He clicks again...This guy is taking some risks today."



"Looks like he's going in for the most difficult move yet, the Goldhaber Nose Click. And it's good!"

NOW, AN UPDATE ON THE TOPS NETWORK CHALLENGE...

Frank: You know Chet, since people have discovered how quick and easy it is to install a TOPS Network, things have gone wild in offices all over the U.S. It seems like installation techniques are getting wackier all the time!

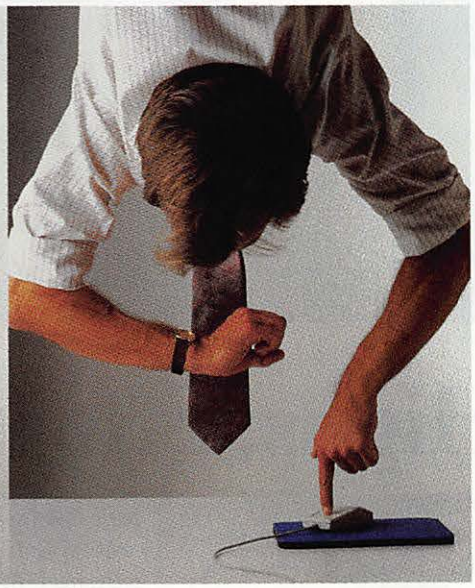
Chet: And faster, too, Frank. It's hard to believe that with only five clicks of the mouse you can turn your Macintosh® into a LAN workstation. In a total elapsed time of less than one minute.

Frank: It's all because TOPS is the easiest to use network in the Mac and PC worlds. If you already have AppleTalk® cabling in place, all you have to do is insert the TOPS diskette, click the mouse five times, and you're ready to start sharing information.

R STARDOM.



"Chet, I'd say this installation could put him into the TOPS Hall of Fame. He spins... there's the click! Can you believe this performance?"



"And he's up, on one finger. It's installed! I've never seen this before...A new record of 59.6 seconds!"

Chet: And with just a few more clicks, you get print spooling. It's no wonder these folks have the time to develop such incredible maneuvers!

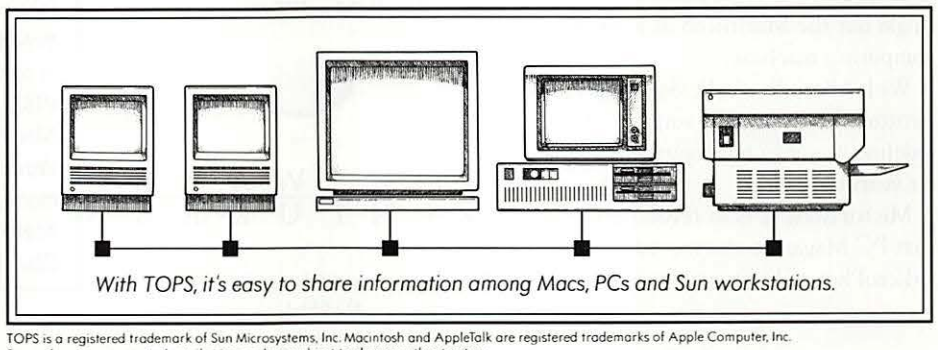
Frank: Right you are. And that means users not only share their printers, but with TOPS they can share their hard disks and MS/DOS files too.

Chet: But you know me Frank. The thing that excites me the most is the price. TOPS/Mac costs only $249 per node, and there's no need to purchase an expensive dedicated file server.

Frank: You bet, Chet. With the lengths people are going to, I'm sure this is going to become a major international event...

Want to try it yourself? For more information call us at 800-445-TOPS (from outside the U.S. and Canada, call 415-769-8700). Or write to us at TOPS, 950 Marina Village Parkway, Alameda, California 94501. And get ready to become a network star.

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Telecommunications software for the Macintosh, a new version.

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When Software Ventures set out to create MicroPhone, it had a simple mission: to develop the most intuitive communications software ever written. Indeed, when MicroPhone was born, it was universally hailed as a breakthrough in communications software. A product so friendly, it turned novices into experts. So sophisticated, it became, in the words of MacUser, a power user's delight.

MicroPhone is a legend. One of those precious software creations that single out the Macintosh as a superior computing machine.

With MicroPhone II, Software Ventures has set out to surpass itself: redefine power in telecommunications for years to come.

MicroPhone II is so revolutionary that PC Magazine was moved to say: "MicroPhone II is arguably the best comm software ever written." We won't have it any other way. MicroPhone II. The freedom to be yourself. At the top.

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Stewart Alsop, P.C. Letter:
"MicroPhone . . . sets the standards that general-purpose communications software will have to follow."

The New York Times:
"MicroPhone is a breakthrough in communications software . . . "

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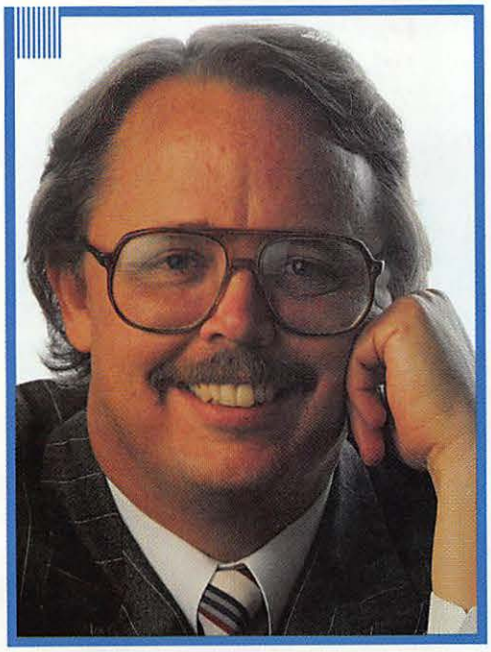
Supports import and export of scripts as text files. Allows control of PBX's, Hayes and non-Hayes modems through flexible modem drivers. Runs at 50 to 57,600 baud. Emulates DEC VT52, VT100, and TTY type terminals. Mac II and LaserWriter compatible. Works with all Mac large screen monitors. Supports the extended keyboard. Built-in text editor. Includes Glue, licensed from Solutions, Inc.

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Circle 48 on reader service card

David Bunnell

Engineering a New Mac Market



Or, is it already too late for Apple to reach some of the Mac II's natural friends?

I see in recent issues of *Fortune* and *Business Week* that Apple is inviting readers to discover what the Mac II can do for their businesses. The II has not done as well as was hoped; the Mac SE is the current sales darling. Estimates I've seen indicate that 18,000 SEs are sold each month, and only 7000 Mac IIs.

What I'm wondering is why the Mac II, with its 68020 chip, is sitting in *Business Week* ads flanked by word processors and spreadsheets. During Jean-Louis Gassée's first year at Apple, one of his favorite sayings was, "Apple should be marketing to its friends." He often mentioned how many high-tech and engineering firms were purchasing Macintoshes. So why aren't we seeing Apple's ads in *Scientific American* and other magazines favored by engineers and scientists?

There are about three million engineers in this country. They use computers for word processing and databases, and they need better graphics in all of their applications than do other PC users. They also tend to be more informed about the technology in general, and they really care about what kind of chips their PCs have.

These engineers and scientists are the natural friends of the Macintosh. Certainly their companies spend more on workstations than do most companies with white-collar workers, where the allure of machines that cost under $1000 is irresistible.

I think that Apple is overlooking a potentially larger market in this group than the one it is seeking in business. Meanwhile, Sun Microsystems is preparing to launch its first line of retail workstations. Apple has squandered its head start with the Mac II, and now it's losing its slight lead by focusing the wrong machine on the wrong market. Sun has not so quietly become a one-billion-dollar company, and soon it could dominate the market for scientific and technical desktop computers.

It's not that developers have let Apple down. I know they're trying to push CAD and engineering applications for the Mac II. But Apple isn't helping them. This is very different from the way the company's marketing executives created and advertised desktop publishing alliances two years ago. There are no equivalents to the campaigns featuring Living Videotext, Filevision, and PageMaker that we saw then.

If Apple were interested in creating a greater demand for the Mac II in the technical user market, it would have already signed deals with national developers to port existing software to its machines. Developers like Daisey, The Mentor, and Valid for integrated circuit design; SDRC, PDA, and Swanson in engineering; McAuto and Control Data in CAD. How can a company savvy enough to build a Mac II overlook its loyal developers and the major software vendors in one of the most lucrative markets of all?

During a recent Apple developers' conference, there were several questions from developers asking when Apple was going to add a plotter driver to system software print drivers. The glib answer from an Apple staffer was, "We can develop our own as quickly as we can buy one from another company." It's clear to me—as it was to the audience—that Apple intends to sit on the issue until it is forced to act. Whenever developers ask questions at Apple's public forums, I sure don't see many Apple executives in the room. If they were there, maybe they would be better prepared to deal with the competition from Sun's new desktop machines.

It's as if Apple has forgotten that it can create its own role in the business market. It has a tremendous entrée into technical corporations like Lockheed and General Electric. These are places where the II could sell like hot cakes, but Apple seems determined to slavishly emulate IBM and only go corporate. That's about as smart as treating the Apple II line as a poor relation, instead of realizing that it's a moneymaker with a very healthy installed base. Apple should be so lucky as to develop the same kind of market in engineering—and it will need a lot of luck to make up for its neglect of this important arena. □

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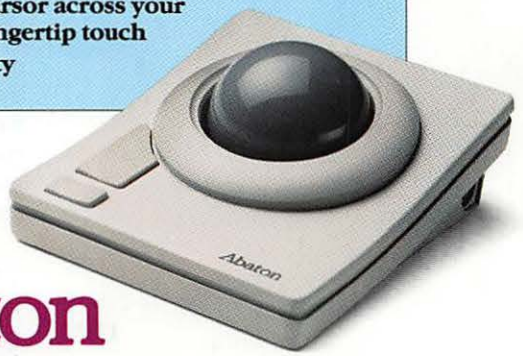
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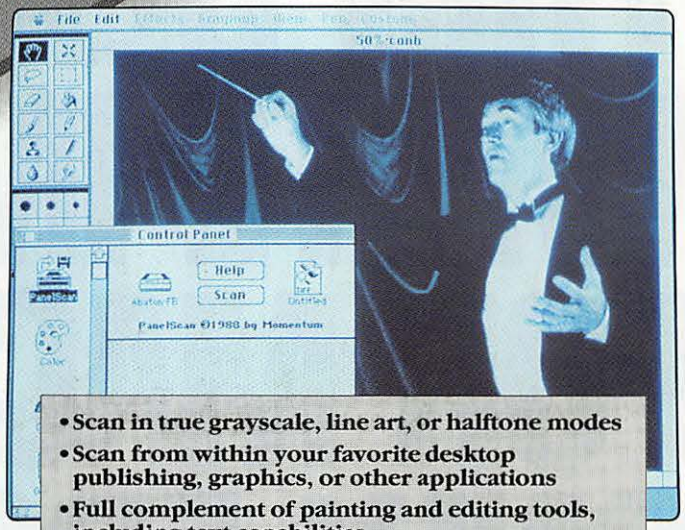
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Letters

A forum for Macworld readers

Rising from the Ashes

It is with mixed emotions, mostly disbelief, that I realize Ashes to Ashes may be one of our most successful programs. It was born out of momentary boredom while Stanley Crane and I were learning to program the Mac. At a trade show, Stan found a couple of copies in his pocket and gave them away. Since then, they've been turning up everywhere. I keep magnets on my refrigerator so they won't take to breeding in the lettuce bin.

Your response to Jim Flores's complaints about the bug that causes the score to decline at the 200,000 mark (*Letters,* March 1988) expresses our mercenary sentiments exactly—why put extra time and effort into a program that's provided us no income? I might also add that no one had broken 200,000 before the game made its public debut. We'd fix it, but we're not entirely certain we still have the development system. Maybe there's a copy in the butter dish . . .

Daniel Matejka
via CompuServe

Landscapes in Color

Are there any programs that will colorize black-and-white MacPaint images on the Mac II? Also, are there any fractal programs that can produce color mountains and other landscapes?

Robert A. Wyatt
Berryville, Virginia

Correction

*The 24-bit programmable color video card shown on page 113 (*Macworld News, *May 1988) is the Spectrum/24 by SuperMac Technology, not RasterOps. It offers 1024-by-768-pixel resolution and sells for $2995.*



JOHN HERSEY

Colorizer (Palomar Software, 619/721-7000), PixelPaint (SuperMac, 415/964-9694), and Modern Artist (Computer Friends, 503/626-2291) all convert black-and-white images into color. One fractal program, Fractal Islands 5.0 by Scott Berfield, does color landscapes, but you're limited to green mountains and blue water. There are a number of Mandelbrot color fractal programs, including MandelColor 5.1 by Robert Woodhead, Mandelbrot Microscope by Martin Sandberg and William Hembree, and Mandel881 by Stephen Eubank. All are public domain except MandelColor, which is shareware ($10). You can get them through EduComp, CompuServe, or various user groups.—Ed.

Buyers Be Aware

We were appalled to read Steven Levy's column about ComVest's glitzy, get-rich sales operation ("When You Wish upon a VAR," March 1988). Although millions of people fall prey to these marketing techniques each year, you shouldn't judge all VARs by this one example. Like us, most Apple VARs are committed to improving the business environment of their clients.

We work very hard to maintain our valued partnership with Apple. In response to your warning, "Let the buyer beware," we say, "Let the buyer be aware that most VARs offer worthy products at reasonable prices."

Mark Hopkins
Micron Computer Company
Camarillo, California

(continues)

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Letters

Not Just for Typesetters

In "Page-Makeup Roundup" (April 1988), Steve Cummings refers to programs like JustText, TeX, and Textures as packages that "are not for graphic designers." Most professionals agree it is the fanatical pursuit of the finer points of typography that separate the pro from the less finicky craftsperson. WYSIWYG programs are certainly lacking in this respect.

As a teacher of typographic design, I encourage my students to use PageMaker and ReadySetGo as well as JustText. While the last program is less intuitive, its typical results outshine those of the other two. Once Display PostScript becomes available, JustText will become very attractive to those now groping their way through the plethora of menus that are part and parcel of the supposedly easier programs.

Joost van de Woestijne
Utrecht, The Netherlands

A Prize Market

In his April column, "Eyes on the Prize," David Bunnell said just what I've been saying about Apple for a long time. There would certainly be many more Mac owners today if only Apple had offered them an affordable Macintosh.

I use a Mac Plus at work, and I like it a lot. But I voted with my wallet, as Bunnell put it, and bought an Amiga 500 with a megabyte of memory and two disk drives for less than half the price of a similarly equipped Mac Plus. Multiply me by over a million people tired of waiting for an affordable Mac who decide to buy something else, and you can see Apple is obviously missing a large market.

Larry Kollar
Dawsonville, Georgia

Protecting Its Image

No business likes to mess with a successful product—in Apple's case, the Apple II line (David Bunnell, April 1988). Until Apple is relatively sure that a cheap Mac won't hurt sales of the Apple II, you won't see a significant drop in the price of the Mac. If the Mac maintains its fashionable image and newfound business contacts, the price may stabilize or even increase.

Apple may be afraid that a low-cost Mac will tarnish its image in the minds of business people, but it may also find the business market is no sure bet either.

Victor Rosengren
Fort Collins, Colorado

(continues)

Christmas in July?



Registered users receive CANVAS 2.0.

If you're one of the 20,000 plus registered users of CANVAS 1.0, we've got a present for you. Starting in July, Deneba Software will automatically mail you the new CANVAS Version 2.0 at no additional cost (no disk fees or shipping charges).

Good just got better.

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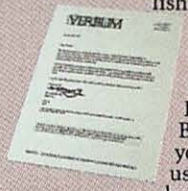
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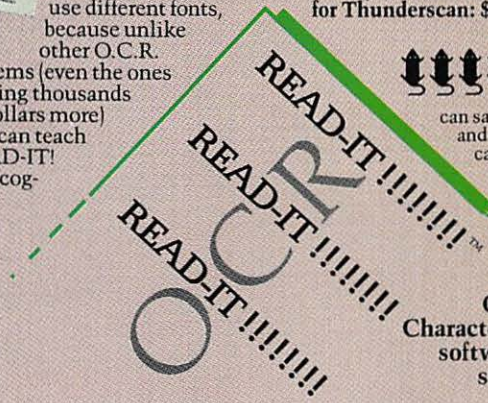


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Letters

Presenting Professional Image

"Get to the Point" (April 1988) was an interesting overview of presentation graphics that contained two slides produced by our software. However, the captions were inaccurate. Our product is called Professional Image, not Management Graphics, which is actually our competitor. The article also quotes typical prices ($15–$50) and turnaround times (4–5 days) for slide services. Our users get slides in 24 hours for $7.

Allan D. Clarke
20/20 Data Systems
Austin, Texas

Fixing TOPS

We enjoyed your informative article on TOPS network software ("Insights on TOPS," March 1988). We use a TOPS LAN, but after upgrading to version 2.0, we discovered that while we could use an SE as a "many writer" server, we were unable to do the same with a Mac Plus. We've been informed that TOPS is working on a fix, but we're still waiting to get it.

Dave Davis
Brøderbund Software
San Rafael, California

Mike Rogers, TOPS technical manager, says the fix will go into the next upgrade, which should be out by now. In the meantime, a patch is being sent to customers who report the problem.—Ed.

Fish or Cut Bait

How nice of Apple to turn over MacWrite, MacPaint, and MacDraw to Claris for further development. But why wasn't MacTerminal given the same treatment? Apple should either get on with MacTerminal's development or admit that it has no plans to do so.

Vanya Matzek
Cupertino, California

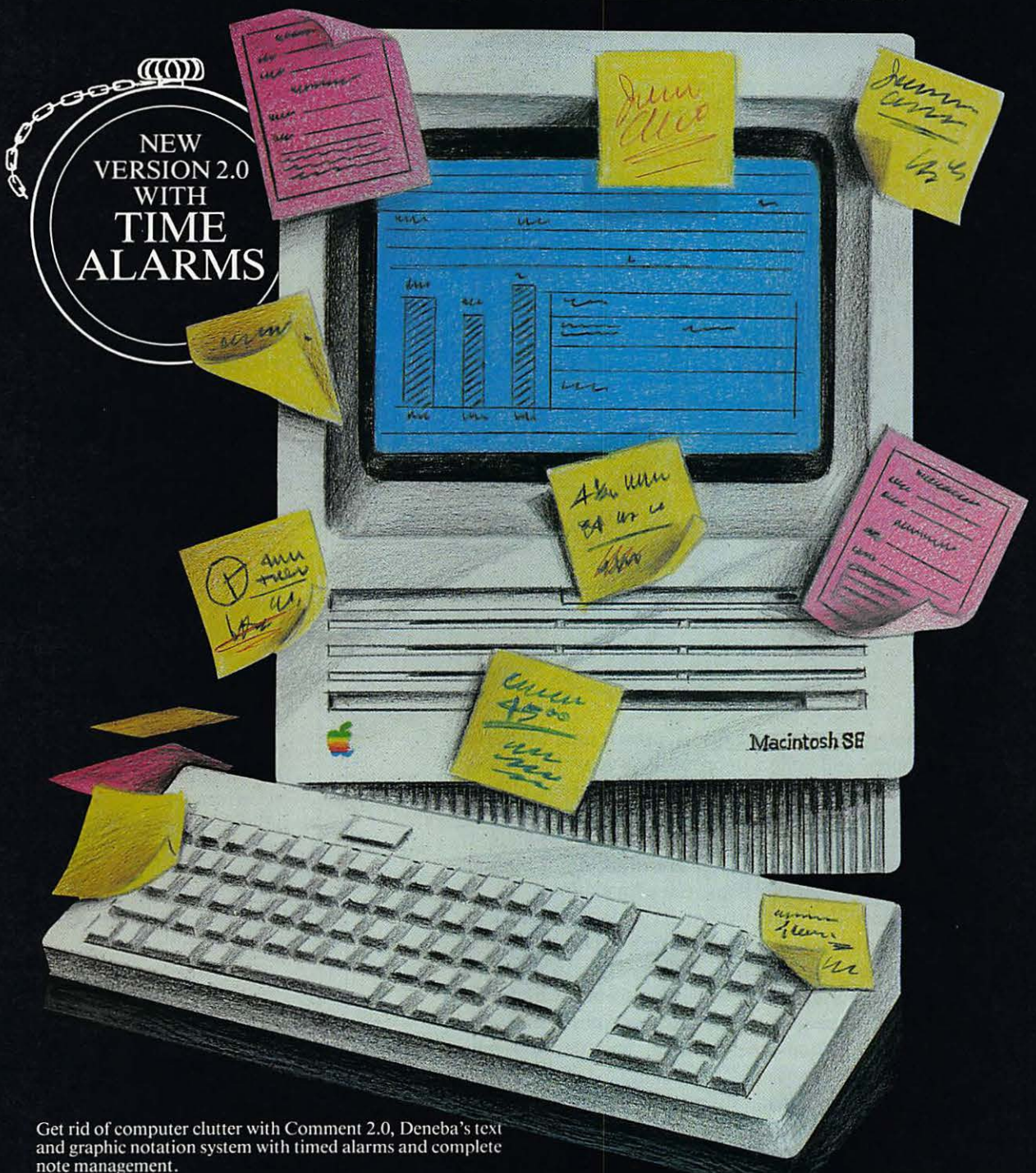
When Apple spun off its software division, it decided to keep networking, communications, and system software, and hand over all other applications to Claris. According to an Apple representative, Apple plans to make MacTerminal a more integral part of future Mac operating systems.—Ed.

APDA Has Its Say

I noted with interest that Apple gave no response to Mark Jennings's complaint about Apple Programmer's and Developer's Association (*Letters,* April 1988). Since APDA is

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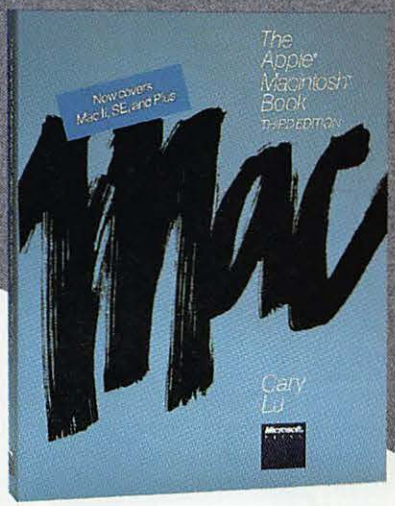


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Letters

an independent organization with a contractual arrangement with Apple, we would be glad to respond to any future complaints.

Since our recent period of unexpected growth, we have improved our turnaround time for orders and customer service. And since we're a nonprofit organization that prices products as low as possible for widest distribution, the $20 membership fee Mr. Jennings complains about is necessary to cover overhead and is required by our contract with Apple.

Frank Catalano
APDA
Renton, Washington

Leading the Blind

After reading about *The Blind Watchmaker* book and program (*Macworld News,* March 1988), I decided I wanted to buy it, but you didn't give an address for the company.

Steven W. Pollard
Montgomery, Alabama

The address for book publisher W.W. Norton & Co. is 500 Fifth Ave., New York, NY 10110 (phone number is 212/354-5500). You can obtain addresses of book publishers by calling your public library or local bookstore.—Ed.

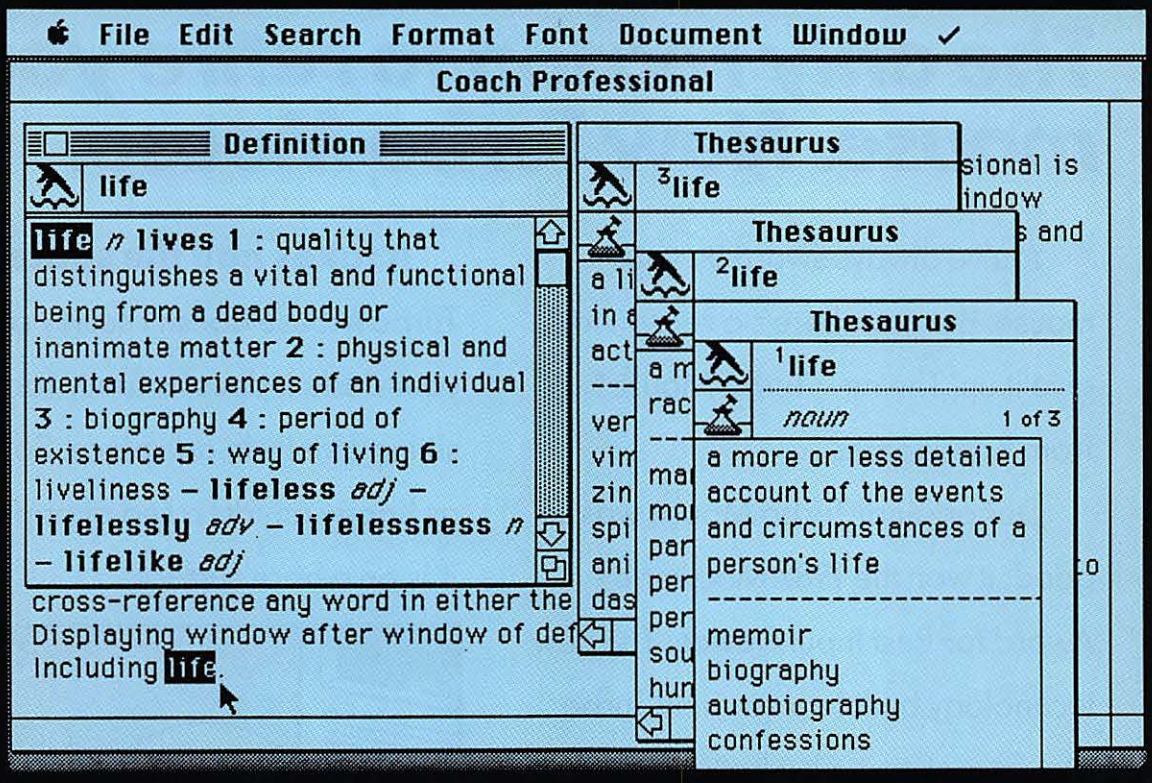
A Sour Note

In "The Numbers Racket" (February 1988) you erroneously claimed that Jazz can read and write WKS and SYLK files, including formulas. Lotus technical support informed us that Jazz only imports WKS or SYLK files; it cannot export them. Only Lotus 1-2-3 version 2 can read Jazz files and save them in another format.

Rita Gelhausen
St. Meinrad, Indiana

You're right. Lotus's planned export utility for Jazz 1.A failed to materialize; this feature is now supposed to appear in Modern Jazz.—Ed. □

Letters should be mailed to Letters, Macworld, *501 Second St., San Francisco, CA 94107, or sent electronically to CompuServe (70370,702), The Source (BCW440), or MCI Mail (addressed to* Macworld*). Include a return address. Due to the high volume of mail received, we regret we're unable to respond personally to each letter. We reserve the right to edit all letters. All published letters become the property of* Macworld.



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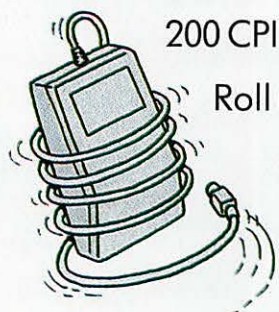
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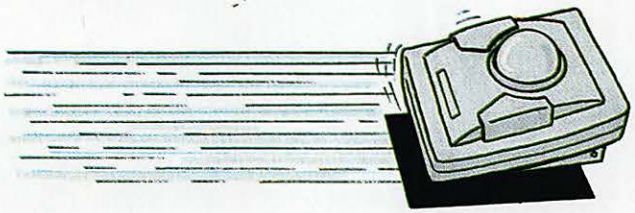
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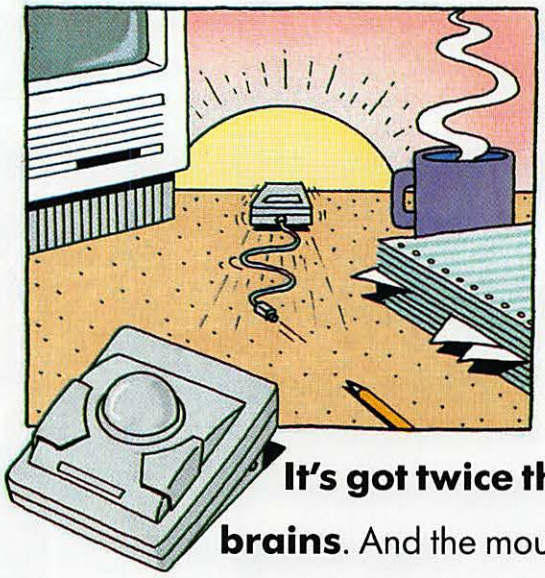
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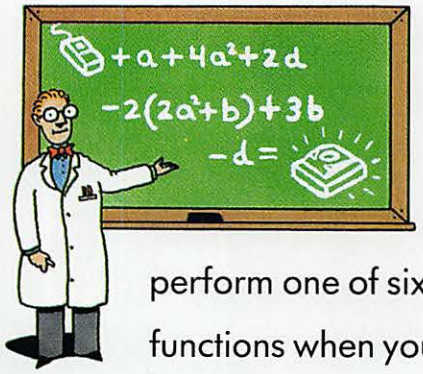




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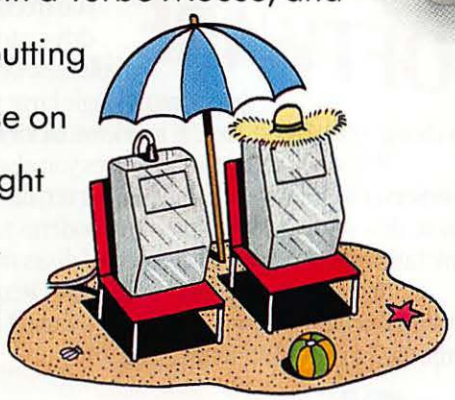


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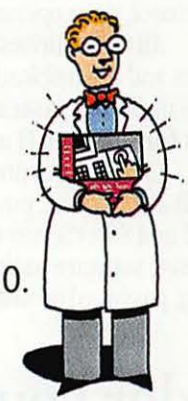
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How Hollywood Moved to Silicon Valley

Or, what multimedia really means

We sat outside on the lawn, squinting against the sunlight on one of those glorious first days of California's spring. Trip Hawkins, founder of Electronic Arts, was talking about the future of the game industry when the conversation shifted to his observations of Silicon Valley.

"Within 20 years this will be Hollywood. Look, the computer game industry is already here in the Valley—Activision, Spectrum Holobyte, and Electronic Arts, with Brøderbund nearby in San Rafael. Together we produce the majority of all entertainment software for all home computers. When we have optical memory, sound, interactive graphics, and better software, we'll be producing applications that rival films from Hollywood."

One might expect to hear this from the founder of EA. After all, Hawkins originated the idea of calling programmers producers and directors. But Bruce Davis, the CEO of Activision (now Mediagenic), a somewhat less flamboyant figure, now has the same starry look in his eyes when he talks about the future.

It's a time of transition in Northern California. It's like Orange County in the fifties, when Walt Disney's vision of the future turned orange groves in Anaheim into Disneyland. Today, the last of the fruit orchards are being cut down around Santa Clara County in the southern end of Silicon Valley. The physical resemblance of Santa Clara's evolution to Los Angeles's is inescapable. Just the names of the places have changed. In LA it was aerospace, petrochemicals, and entertainment. Now, in Silicon Valley, it's semiconductors, computers, and entertainment.

All of the major players in personal computers (save Tandy) are here; Sun, Hewlett-Packard, Apple, and dozens of other computer companies. IBM, DEC, and Xerox all have major research facilities here. George Lucas and Francis Coppola have brought substantial film industry work to Northern California. Industrial Light and Magic, a Lucas company, produces special effects for many of today's films. The Valley has become a cauldron of creativity, innovation, and hard work. Not one that glitters with the sybaritic lifestyle of LA, but one that races along quietly, fueled by the enormous efforts of its engineers, programmers, and marketers.

It's not just hyperbole. I worked for years in Boston and Washington, D.C., prowling the high-tech corridors there, talking with computer company execs, and it's clear to me that there's something different about Silicon Valley now. Excellent companies reside in all of this country's high-tech centers, but now the talent flows noticeably, increasingly, toward the Valley.

It's no coincidence that Apple's new vision of the future involves multimedia, user programmability, natural language use, and the visualization of data. John Sculley's vision leaps ahead to the end results of these trends, while Jean-Louis Gassée articulates the goals that must be reached in order to achieve these ends. And the engineers groan about how to accomplish all that's needed. I sit now and imagine what the book will look like that records this transition.

Gassée's thoughts these days about multimedia go something like this: To be successful, the next generation of machines must be contextual. That is, computers must allow us to work within whatever is our context—in any subject area, by all appropriate means of access (audio, graphic, tactile), in any style of interaction we desire.

'Within 20 years... we'll be producing applications that rival films from Hollywood.'

Second, they must provide "reusable experiences." Unlike videocassettes, computers must give people the perception that there are no bounds to what they can do with them—that each use can be an entirely new experience. (Gassée raises the concern, though, that the computer industry could fall into the media/advertising trap that television has, and produce mindless babble.)

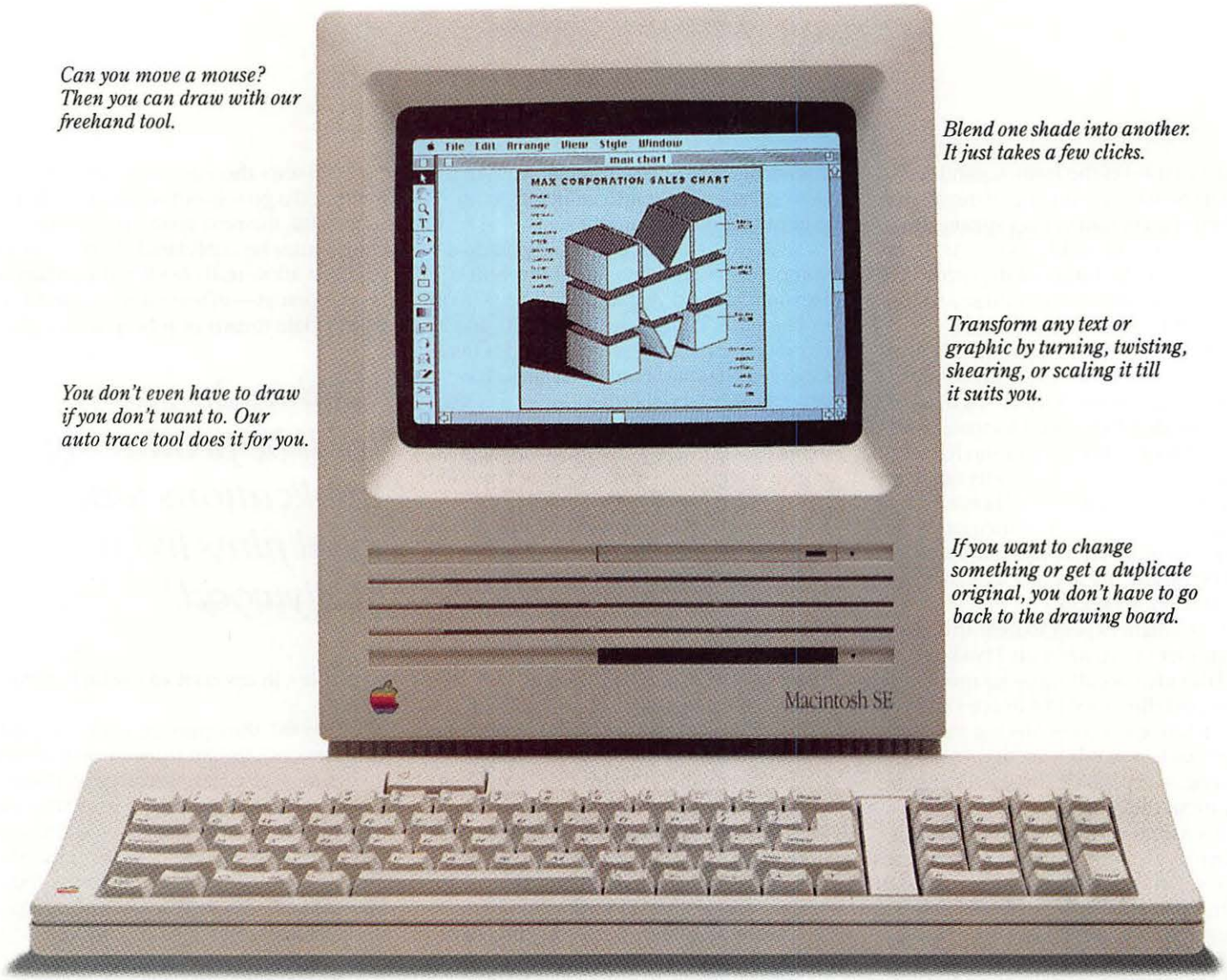
Third, the future machines must be user programmable. It's refreshing to hear Gassée say that HyperCard has allowed Apple inadvertently to begin along this path.

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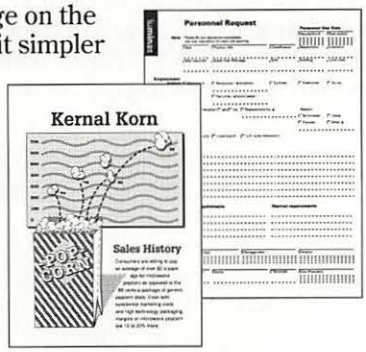
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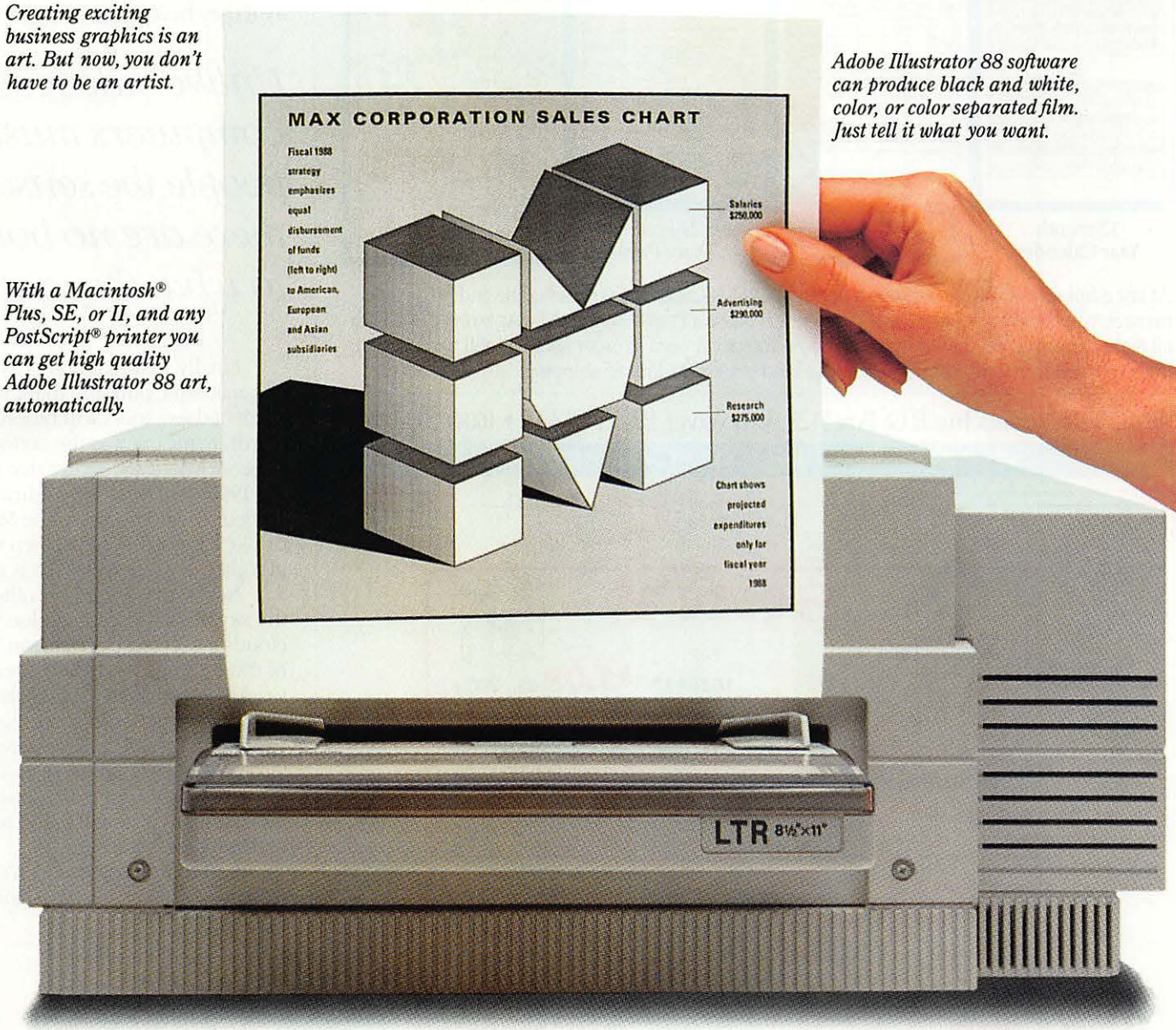
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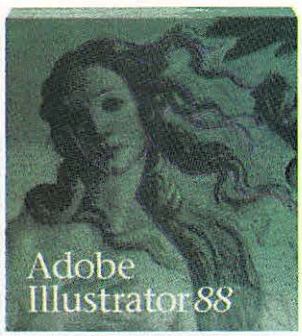


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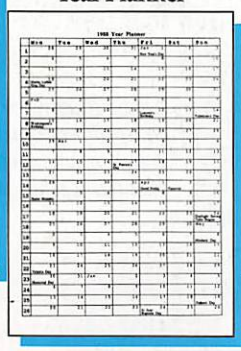
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Commentary/Jerry Borrell

Gassée suggests that user-programmable, multimedia computers must have tools that incorporate a knowledge of aesthetics and other types of rules that nevertheless do not constrain the user's freedom to create. In his example there will be few home users with the skills of a Kubrick, but the computers should allow them the opportunity to create work of masterpiece quality if they have the time and ability to do so.

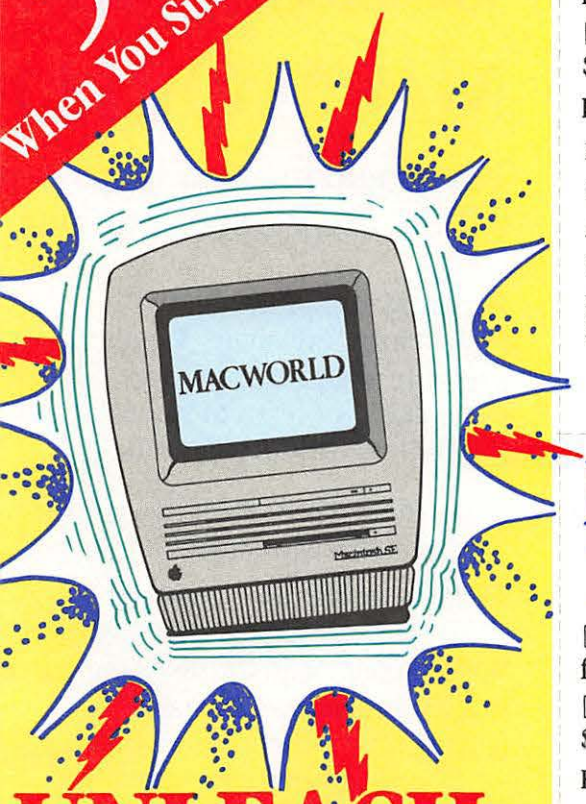
Unlike videocassettes, computers must give people the sense that there are no bounds to what they can do.

Finally, he recognizes (as do few of our academic pundits) that the development of these tools will be evolutionary, not dramatic (as was the arrival of spreadsheets). And if we accept that computers in the 1990s will become cultural icons, like cathedrals and books in the Middle Ages or like cars in the 1950s, then we can glimpse for ourselves what is coming.

Now when I sit in my office and notice the sky become brilliant blue with white clouds sweeping over Silicon Valley, I think of these things. And I try to remember that Cricket Presents and PageMaker represent only some fraction of the progress that we need to make. We have at least begun, and have made great progress, but so much more is needed. I feel the desire to spend more time working with the technology and less time observing.

Isn't that what used to send people to Hollywood a few decades ago? □

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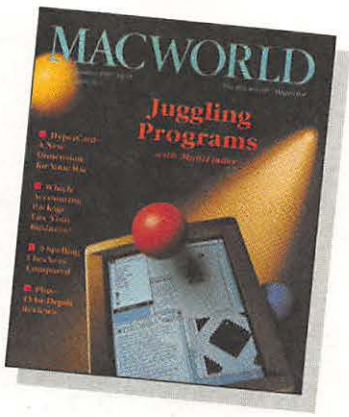
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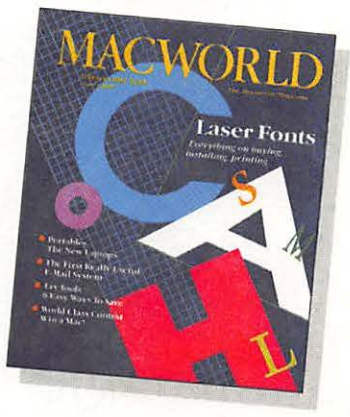
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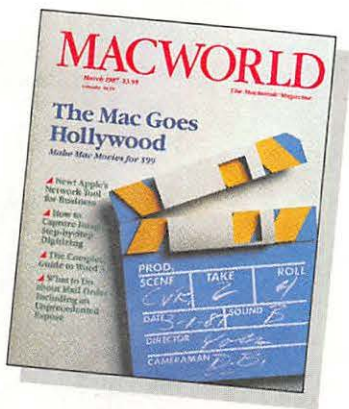
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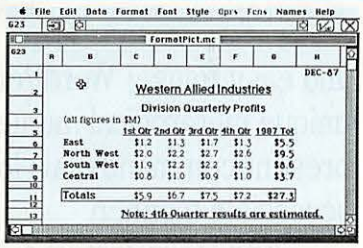
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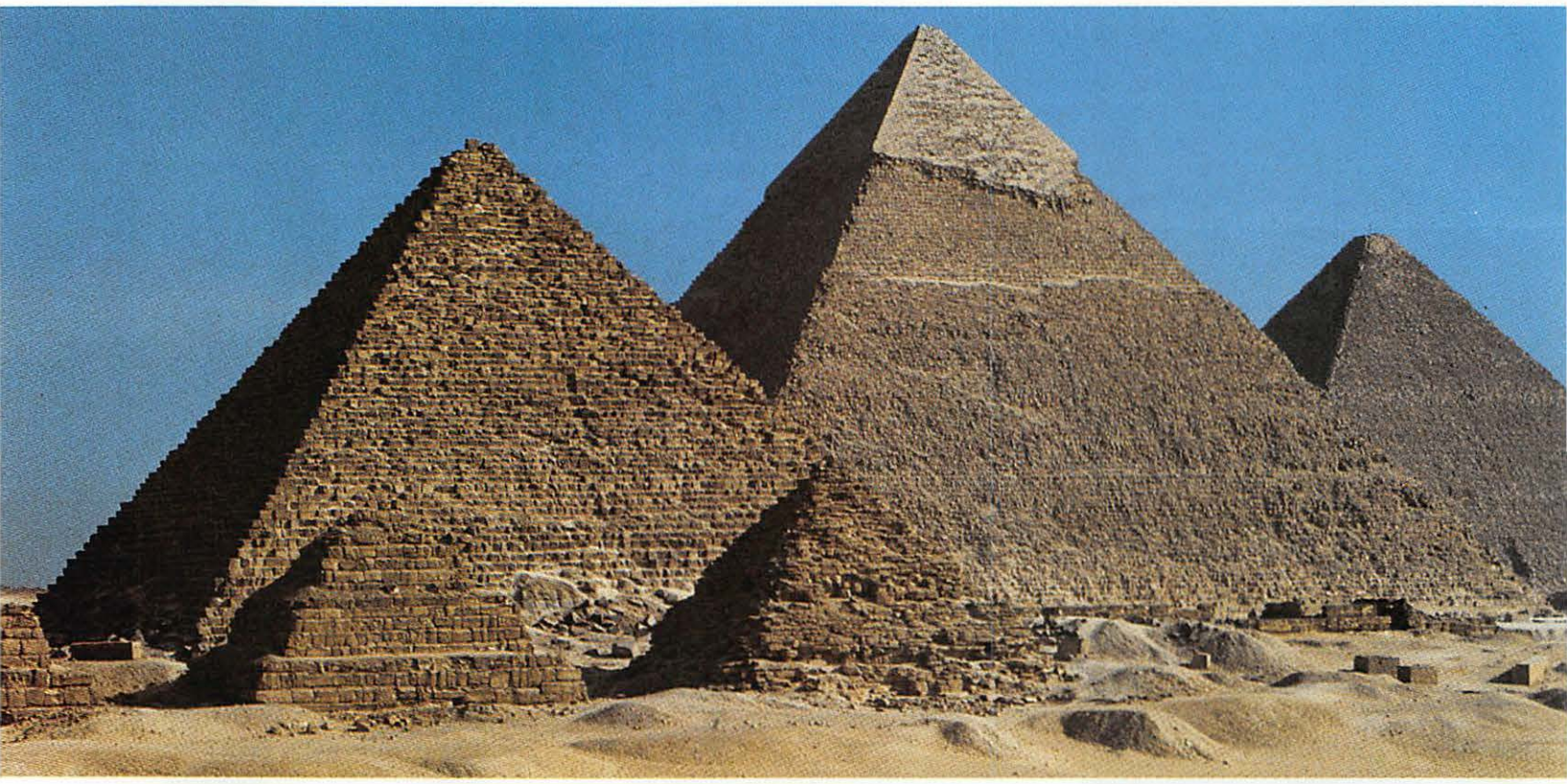
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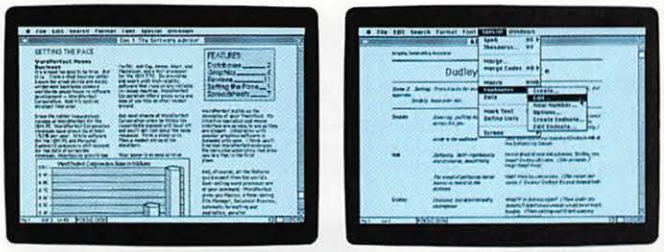
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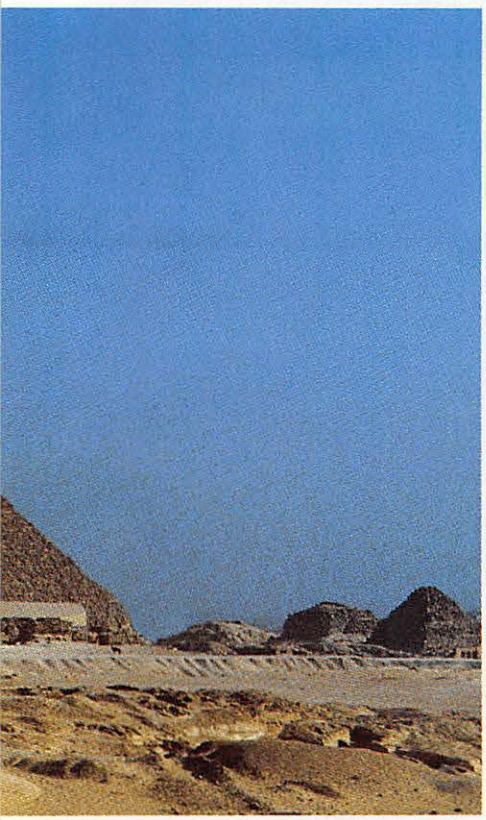


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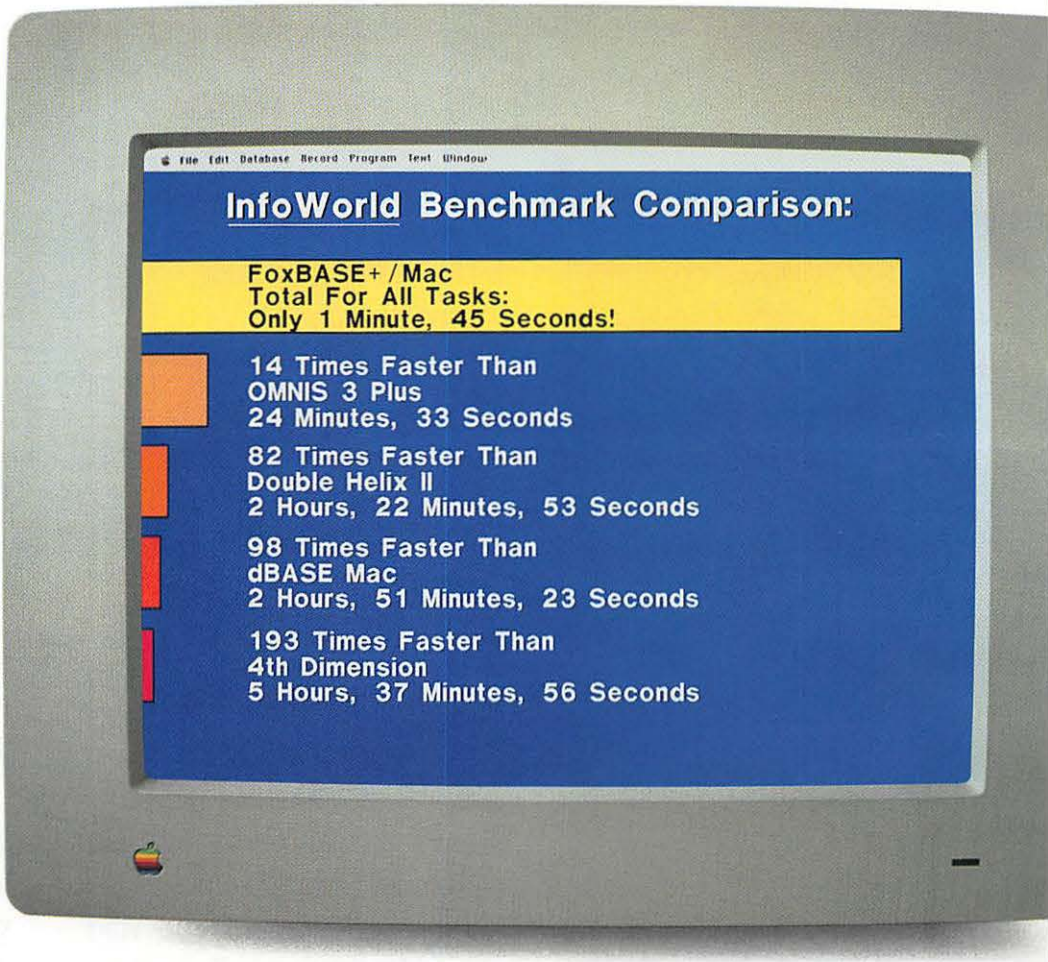
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Steven Levy

Whose Music Is It, Anyway?

New Mac software makes virtuosos out of the fumble-fingered—so why learn the hard way?

My first guitar was a gnarly hunk of wood and string purchased for $19.95 from the Sam Goody's retail chain. Oh, did it sound awful. But at 15 years old, I was convinced that it could make me sound like Bob Dylan, and maybe impress some females, so I hammered away at it until I made some sounds that were, well, adequate. I forced the fingers of my left hand to press down hard on the strings, which felt as rough as bridge cables, until the fingertips bled, blistered, and finally developed soothing calluses. My right hand had an even harder task—it had to learn to move in a totally unnatural manner. *Down* up down up, *down* up down up . . . done slowly and still botched, then done slowly and not botched, until miraculously, as if my hand had secretly been practicing on its own, the strum was mastered.

I had learned to play guitar. I worked hard at it for ten more years, and when things were very very good, my being bled into the music itself, and maybe I impressed a few females.

So imagine my chagrin when I booted a $50 program named Jam Session on my Macintosh. Brøderbund Software's promises on the packaging implied that all my hard work and practice on the guitar had been squandered. *Make great-sounding music instantly . . . exercise your creativity without ever making a mistake . . . nothing to do except sit back and amaze yourself . . . If you don't know anything about music—who cares?*

Steven Levy is a Macworld *columnist and the author of* Hackers: Heroes of the Computer Revolution *(Dell, 1985).*



MAX SEABAUGH

Could it be true? Could randomly hitting keys on my Mac Plus actually provide better guitar accompaniment than a Martin D-28 and my years of labor?

Yes, damn it. From the 19 possibilities, I chose a song called "Berry Jam," billed as "Classic rock 'n' roll from the '50s," and on my screen came an illustration of a rock group. Then the music started, a standard chord progression with bass, drums, and rhythm guitar. Even through my Mac speaker, they sounded like real instruments; they sounded more real when I patched the computer into my stereo system. All that was missing was the lead guitarist . . . me. Each letter on my keyboard corresponded to a guitar riff or note, all of them appropriate to a Chuck Berry–style rave-up. Most amazingly, the riffs would automatically accommodate themselves to where the song was at any given moment. No matter what I played, it sounded right.

I had to admit it—if I had plugged in a vintage Fender Telecaster and amplifier and attempted to play lead the old-fashioned way, any discerning rock fan would have chosen the prepackaged version.

(continues)

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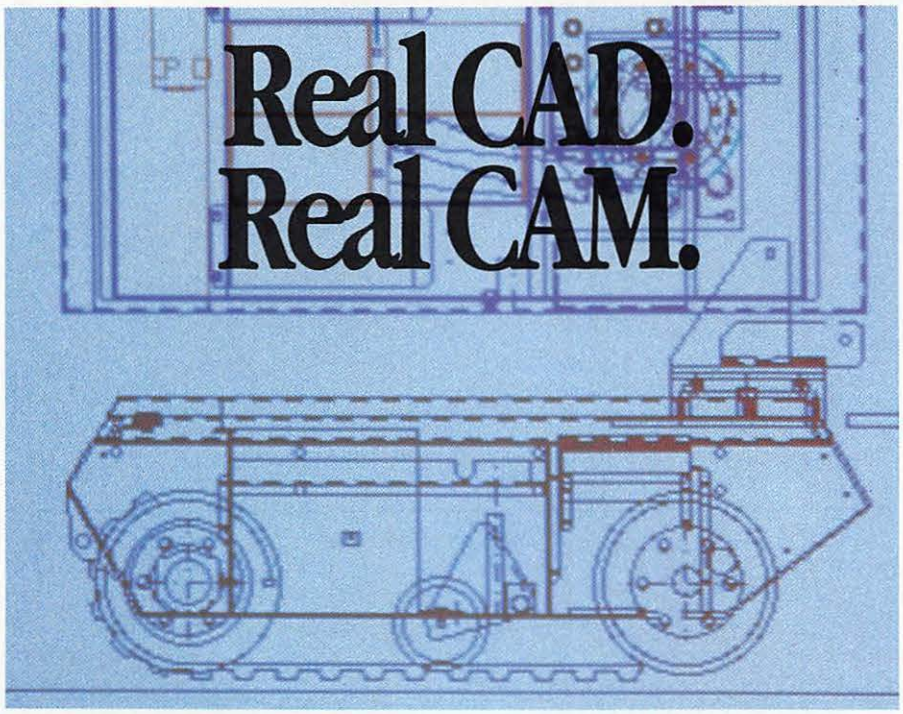
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Steven Levy

At that point, the delight of my new computer toy overwhelmed the feeling that the hours spent honing my technique had been in vain. I tried the different songs, some of them giving me the power of a jazz pianist, a country banjo-picker, or a techno-hip synth player. With each song I got more excited—I just could not believe the music I was making.

It was only later that I dared asked myself a daunting question: Was I really making music? Or was this some sort of stunt, a cheap trick? If this was *really* music, then I think we have to make some major adjustments in our view of what musicianship consists of.

To probe this conundrum I took a look not only at the origins of Jam Session, but also at those of a couple of other programs that provide high-level music output for people with low musical skills, and found that the issues behind these programs were almost as fascinating as the sounds they produce.

Bogus Music

Ed Bogas has had a checkered career in the music business, ranging from the composition of the soundtrack for television animation featuring the beloved but not very funny Garfield character, to an appearance as a clucking chicken in commercials for the California Egg Board. Now he's focusing on computer software, particularly for the Mac. It was Bogas who headed the team that created the popular Studio Session program, which uses the metaphor of a multitrack tape recorder to allow users to create songs in layers, adding one instrument track to another. (By doing this, Bogas was offering a low-end version of professional sequencer programs, which use the Musical Instrument Digital Interface, or *MIDI,* standard to manage studio-quality recordings.) But to get the most out of Studio Session, one had to know something about musical notation and composition. Bogas wanted to bring things down to the level of musical moronhood.

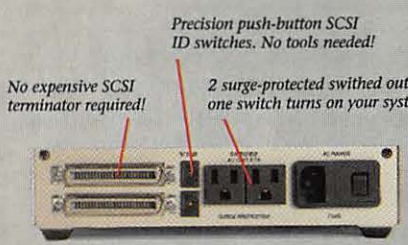
"A team of us were working on a toy project," he recalls, "where you could push a button and have elaborate sound come out. Then one day I was sitting at the piano keyboard and thinking about the way a jazz musician operates. He has a bank of

(continues)

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ON THE FLY

6308 Troutmask Lane, Stillwater, Montana

A Memo On The Lures Of Trade



We at *On the Fly* lures want to ensure that the wily, sought-after creatures of the watery world are as captivated with our fishing customers as our customers are with our fine lines of natural, organic hand-tied flies. The line of lures we offer this year will, indeed, reel in customers as never before.

Tackle your fancy.
For the young novice angler looking to launch the hobby with tamer game, *On the Fly* will offer a range of smaller, lighter, less intricate lures, such as the Peanut Piper, the Pumpkin Puff,



the Weedy Wiggle and the Puddle Jumper. These lures are designed for easy handling, both on and off the hook. For the reel man who chums for larger catch, the new additions to our 1989 product line include the Chimmer Swizzler, the FinchDog Fighter, the Man-Boy Behemoth and the Brassy Bottom Bonanza. These additions for 1989, plus the full line of tried-and-true *On the Fly* lures are on the following pages.

Lure, line & sinker.
Our *On the Fly* authorized dealers have long been aware of both our in-store and customer support services. This season is no different. In fact, in addition to our advertising budget, we have plans to expand our in-store displays and re-package the lures for easier inventory and handling.

PROJECTED SALES FOR 1989*		
	CHIMMER	*BONANZA*
100K	NO	YES
50K	YES	YES
25K	YES	YES
10K	YES	YES
5K	YES	YES

Hold the anchovies.
For our customers, we plan to initiate a toll-free 800 number to widely distribute information such as matching lure to fish, bait tips and techniques, hot spots for fishing and spawning cycles. With this service, the fishing line of our market will always be busy.

** SALES FIGURES FOR 1989 ARE JUST A WILD GUESS*

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ON THE FLY

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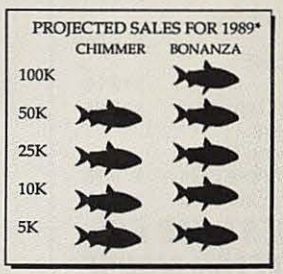


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*Sales figures for 1989 are just a wild guess

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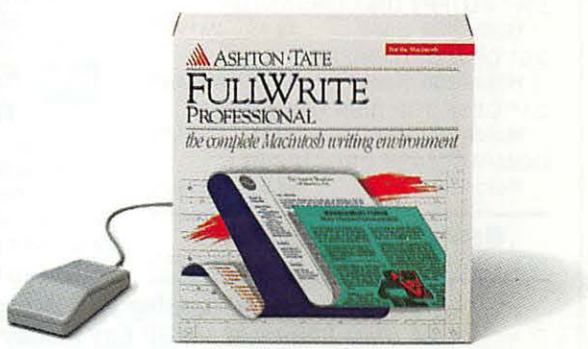
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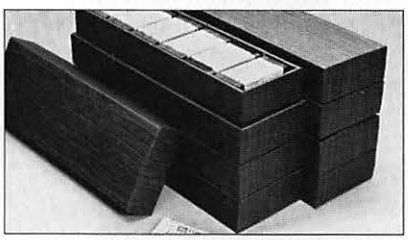
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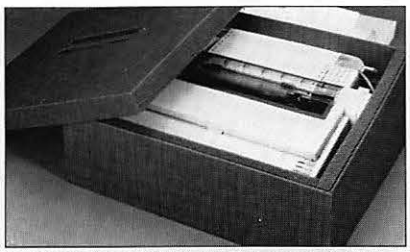


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licks in his mind and, depending on the way he feels and the way the music is playing, he chooses one." It could be a fast one, a slow one, or a single note—it could be anything that fits the composition. A lifetime of experience is behind the choice, as well as a storehouse of dexterity required to play the riff once it's chosen. But Bogas intuited that all the hard parts could be bypassed.

"Why not give nonmusicians the 'chops' the musician has at his or her disposal," he asked, "and let the people make the aesthetic choices?" With a team that included Steve Capps, of the original Macintosh software group, Bogas created Jam Session, which does just that. He knew it worked when one day an observer who had been watching a demonstration began shaking his head and wondered aloud whether Oscar Peterson had just become obsolete.

That thought hadn't occurred to me. To the contrary, I'm not sure at all that when you're jammin' with Jam Session, you're actually making music. But Ed Bogas has no doubts.

"I say you are creating music when you use Jam Session," he says. He explains that you can, for instance, build a jazz solo much in the same way that Oscar Peterson does, choosing slow riffs, climbing octaves, chording. "You have a sense of control," Bogas says. "You can play with feeling. You can express emotion."

Bogas admits that he has not yet heard any solos created with Jam Session that have startled him by going beyond the program's apparent limitations. The John Coltrane of Jam Session has yet to emerge, and it is questionable if he ever will. On the other hand, Bogas contends that nonmusicians are grateful. "They all say, 'It's like suddenly being able to do the thing I've never been able to do before. I'm not all thumbs!'"

Is it possible that the program and ones like it will create a disincentive to traditional music training?

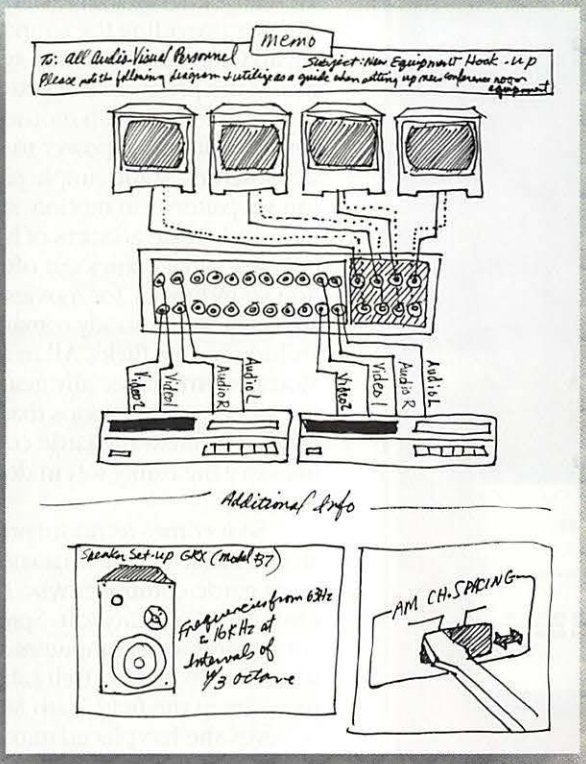
"I don't think so," says Bogas. "I know in music you cannot stop the desire to learn. Most musicians start very young. If they have the inclination, you cannot stop them."

The Mouse That Roared

If I was reluctant to accept that argument, I was more so after toying with another make-music-no-questions-asked program. This one is called Music Mouse,

(continues)

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Steven Levy

available from OpCode Systems of Menlo Park, California. Though the compositions you create with Music Mouse sound less familiar than the instrumentals produced through Jam Session, it gives a rank amateur even more musical power.

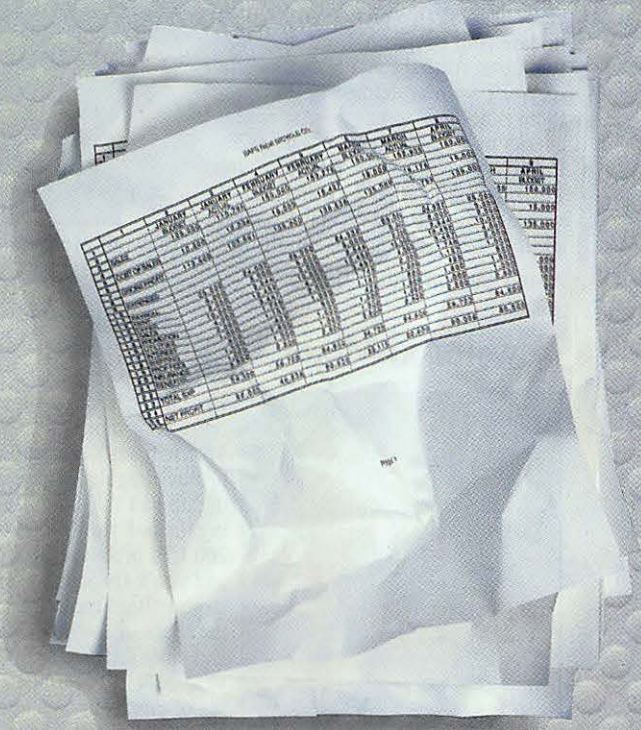
Music Mouse is hard to describe. It is sort of a synthesizer with intelligence. (It is also best used in MIDI mode, with a synthesizer rather than the Mac's internal speaker providing the sound—I used a cheap Casio CZ-101 digital synthesizer.) Basically, the program lets you play music by sliding the Macintosh mouse around; you have considerable power to shape the music by setting some simple parameters. You can set patterns in motion, strike harmonies, and create all sorts of highly evocative phrases. What comes out often resembles film soundtracks, for movies that could be anything from moody romances to spine-chilling horror flicks. All in all, Music Mouse seems especially geared to create the sort of compositions that would be favored by an avant garde composer who lives in a big funky loft in downtown New York City.

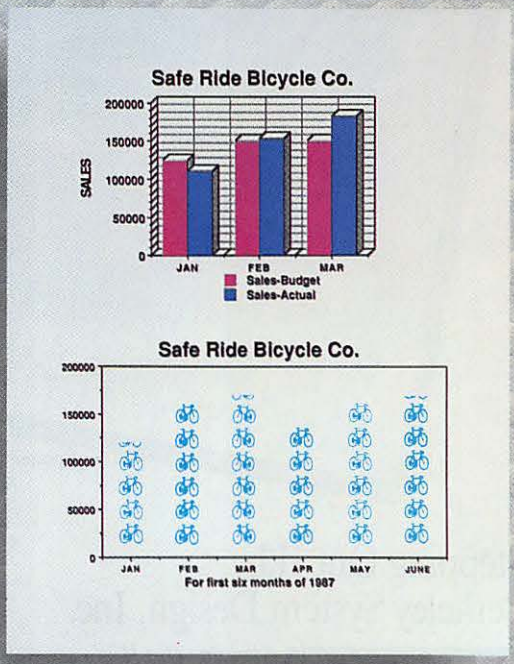
So it comes as no surprise that the creator of Music Mouse is Laurie Spiegel, an avant garde composer who lives in a downtown New York City loft. Spiegel has been composing with computers since 1973, when she worked at Bell Labs with the pioneers in the field. With Music Mouse she believes she has placed maximum power in the hands of minimally trained people, and she makes no apologies about it. In fact, she sees her program as a blow against "tyranny" in the music establishment, which she considers elitist and snobbish.

"First of all," she says, "sheer physical coordination has nothing to do with musicality." So much for those hours of training my fingers to make chords while the other hand picked at strings. "Second, the ability to deal with and manipulate symbolic notation is irrelevant to musical ability." This is rather comforting, since I don't read music. "All in all, we filter out 90 percent of the musicians [by those bogus criteria] and we're left with virtuosos who play piano like it's a sport—without soul."

(continues)

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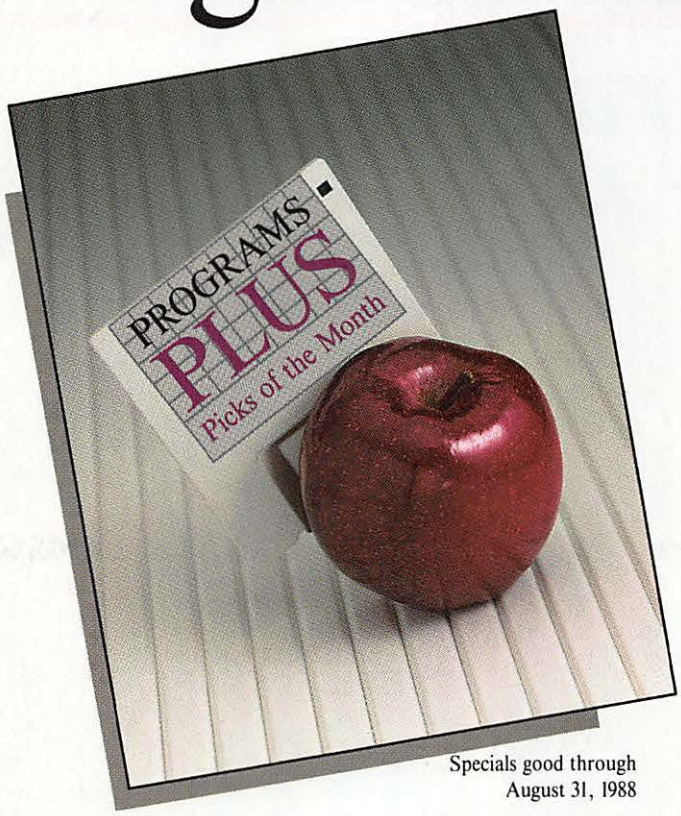
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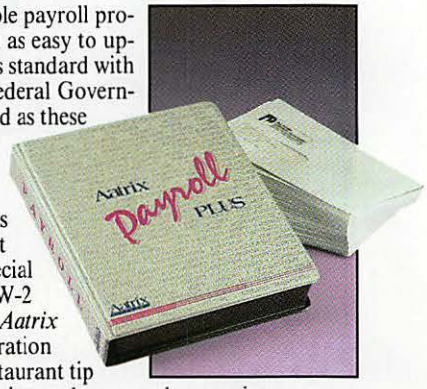
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Programs & Peripherals



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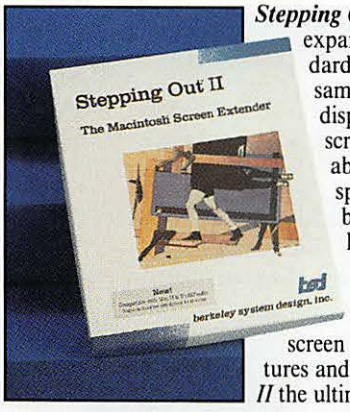
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Aatrix Payroll Plus ..... **195.**

Stepping Out II by Berkeley System Design, Inc.



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Stepping Out II ..... **54.**

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New Turbo Mouse ..... **115.**

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Cortland		with Smart Alarms	85.
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Greene, Inc.		SmartScrap & The Clipper	35.
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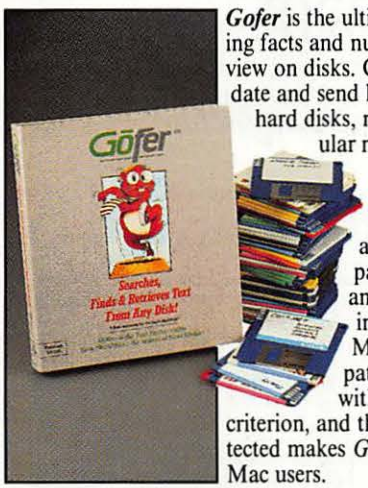
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Chuck Yeager's Advanced Flight Simulator ..... **36.**

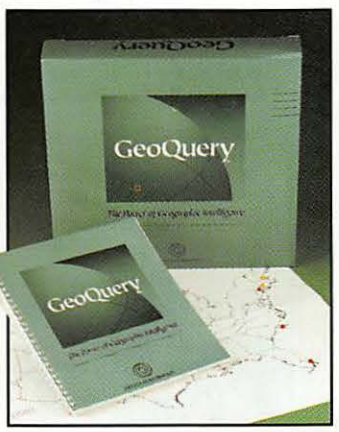
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Business Card Maker	36.	Pro Challenge or Basketball Challenge	31.

Music Mouse is her blow against that music establishment, but it is more than a musical tool. In fact, the program is so powerful that it goes beyond categorization. So easy to use that it has found favor with people attempting to rehabilitate prisoners and raise the self-esteem of physically impaired people. At the same time, such an intricate musical composition aid that professional musicians have told Spiegel they consider the program a full collaborator—and they've listed it that way on record albums and in performance notes.

This brings up an interesting question. Since it is so easy to produce engaging music with Music Mouse—one can virtually press a few keys on the Mac, step back, and listen as the program generates complex counterharmonies and rhythms—is it the user or the program that has created the music? Or the creator of the program? The problem is so vexing that the U.S. Copyright Office has yet to figure it out. In fact, it still can't decide whether Music Mouse is a software program, a musical instrument, or a musical composition with infinite sheet music.

Meanwhile, Spiegel does admit that extending such power to nonmusicians—or boosting the power of trained musicians—can have its problems. She cites one example: the faculty at the Berklee College of Music is having trouble judging student tapes because "they can't tell who has talent or who used the software to do the creation for them."

Music for Millions

Certainly that confusion will only get worse as this genre of software proliferates. The Intelligent Music Corporation of Albany, New York, which publishes somewhat more technical composition programs like M and Jam Factory is, according to its president Joel Chadabe, planning several programs that will enable musical virgins to make music. One is a mouse-driven program called Ovaltunes; another, called Riff, is "an improvising program that places a band of players under your direction."

Ultimately, does it matter if software makes Eric Claptons out of klutzes, or Steve Reichs out of the tone-deaf? When we hear or create pleasing or stirring music, what difference does it make how much sweat went into creating it? The creators say that Music Mouse, Jam Session, and other tools provide the essence of music without the fuss and muss, and that those with superior imagination, musical intuition, and theoretical vision will use the composing aids to go further. I have to admit that when I play with those programs, I am pleased with the sounds that emerge. As an added bonus, when I play a sizzling guitar lead on Jam Session, my face does not make the silly contortions endemic to note-bending lead guitarists.

On the other hand, I cannot imagine this brand of musicianship—which entails moving a mouse or hitting letters on a keyboard—as capable of elevating a teenage boy to Life of the Party, thus impressing females. As long as that's so, don't look for the computer keyboard to be the nexus of music creativity. □



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MACWORLD 8/88

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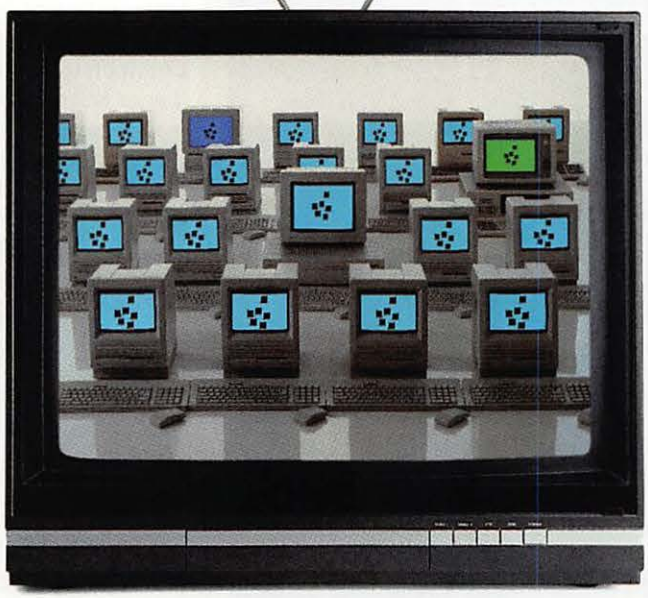
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Circle 462 on reader service card

Network news.



We always wanted to keep a low profile. But since we introduced the PhoneNET System two years ago, hardly a week goes by that we don't make network news.

A leading Macintosh magazine advises that you install PhoneNET for any AppleTalk network. The PhoneNET StarController was selected as the best way to build large networks. And reporters are calling MacRecorder the new wave in sound technology for the Mac.

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Macworld News

by Gil Davis

Desktop Video

Thanks to desktop video, which processes images and sound, in addition to words, the art of storytelling is evolving rapidly.

In fact, novelist Ken Kesey (author of *One Flew Over the Cuckoo's Nest*) predicts that the Kafkas and Joyces of tomorrow will be using video as a means of expression. Already desktop video is producing segments of animation that look as if they might have been done on a much more expensive Pixar or Cubicomp system.

Aegis's video products for the Mac have helped create several TV commercials and music videos, including Coca-Cola's Max Headroom commercials and other productions by Timbuck III, Tom Petty, and Todd Rundgren. A key element is Aegis's Animation Workshop for the Mac II, which offers full-feature video titling with cell animation; the manipulation of video images with flips, turns, tumbles, and rolls; an animated-image compression system (to greatly increase the number of images that can be stored on a hard disk); and a HyperCard link with a 3-D animation player. Animations can be played back at a rate of up to 30 frames per second (fps) from a disk or up to 100 fps from RAM.

To implement desktop video software, Julian Systems is offering an NTSC video card to hook up standard video monitors to the Mac II. The company will soon be releasing a Mac II video production card, which will permit standard video signals to be mingled with Mac images.

If you're interested in creating your own movies or commercials—complete with soundtrack, animation, and special effects—for under $10,000, then a desktop video system may be your best choice. For further information, call Aegis in Santa Monica, California, at 213/392-9972; and Julian Systems in Concord, California, at 415/686-4400.—*Allan Lundell*



MAX AGUILERA-HELLWEG

Television commercials, training videos, animated films—all created using the new capabilities of desktop video, which Aegis and other developers are bringing to the Mac.

Easy Access to SQL

Mac users can easily and quickly use the power of SQL databases on Digital Equipment Corporation's VAX computers without sacrificing the Mac interface, thanks to Alisa Systems' SequeLink. Alisa's package enables Mac users to extract data from SQL databases (such as Oracle) using programs like 4th Dimension or HyperCard. HyperCard stacks can be created to access SQL databases using SequeLink's external commands (XCMDs). A 4th Dimension application, called SequeView, is included with SequeLink. It constructs queries to an SQL database using a spreadsheetlike format.

In order for SequeLink to work, a user's Mac must be connected to a VAX computer via either AppleTalk or DECnet. When a Mac-generated query for data is directed to the VAX, SequeLink's SQL server on the VAX communicates with the database, extracts the appro-

(continues)



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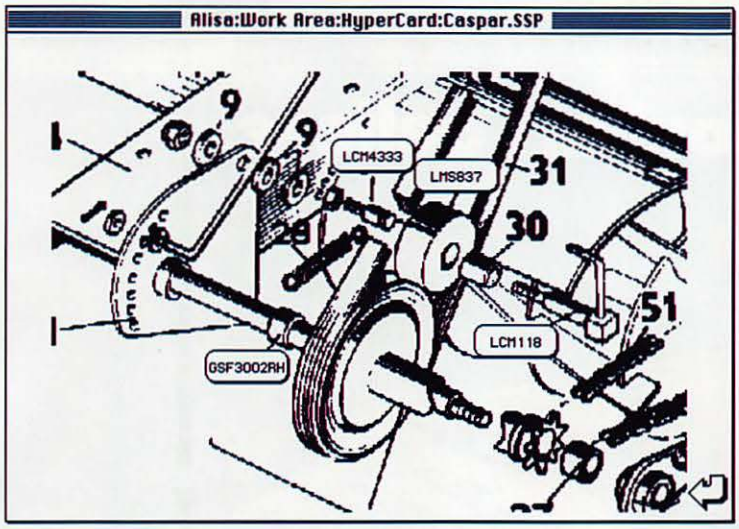
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Circle 161 on reader service card



This HyperCard application accesses information located on mainframe computers. Click on hot spots, like the part numbers above, and up pop new windows.

priate data from the SQL database, and sends only the requested data back to the Mac.

As a result of these features, SequeLink is one of the few products available that provide "seamless integration" of processes running on both the Mac and the VAX computers, making it easier for users to get the best of both worlds.
–David R. Kosiur

PowerPoint in Color

Microsoft's PowerPoint 2.0 presentation software for the Mac produces color slides that will knock your socks off. The program's automatic color palettes let you choose from among eight complementary colors (based on your choice of a primary color); multidirectional washes allow you to create a gradually lightened background; and automatic formatting permits a specified combination of colors and fonts to be applied instantly to all slides in your presentation.

PowerPoint retains all of its capabilities for producing black-and-white slides and overhead transparencies, but it still doesn't draw or paint complex images well. So it relies on such programs as Illustrator 88, FreeHand, and LaserPaint Color II for creating especially interesting backgrounds, which can be imported into PowerPoint 2.0 as PICT, bitmap, or encapsulated PostScript files and placed into one of many layers. By altering the position and density of the see-through layers, it's easy to create unusual embossing and shadow effects, previously available only on much more expensive slide systems.

Once you finish designing your presentation, you can output it on a film recorder or send it to a slide service center like Genigraphics. Genigraphics, which has 24 locations around the country, can produce color slides using files created on any Macintosh (color or black-and-white) through the use of proprietary templates. But beginning in September or October, registered owners of PowerPoint 2.0 will receive a Chooser driver that makes sending slides (via modem) to Genigraphics as routine as printing—completed slides will often be returned to the sender by Express Mail the next day.

Other enhancements to PowerPoint include a spelling checker and a search-and-replace function. PowerPoint's list price remains $395. For further information, call Microsoft at 800/426-9400.

Stop Mousing Around

The Apple Desktop Bus (ADB) is a serial communications bus that allows up to 16 peripheral devices to be connected to the Mac II or SE. Until recently, about the only input devices users could attach to the ADB on either computer were Apple's keyboard and mouse. Now, however, a host of input alternatives have appeared—from tablets to trackballs to devices that defy categorization.

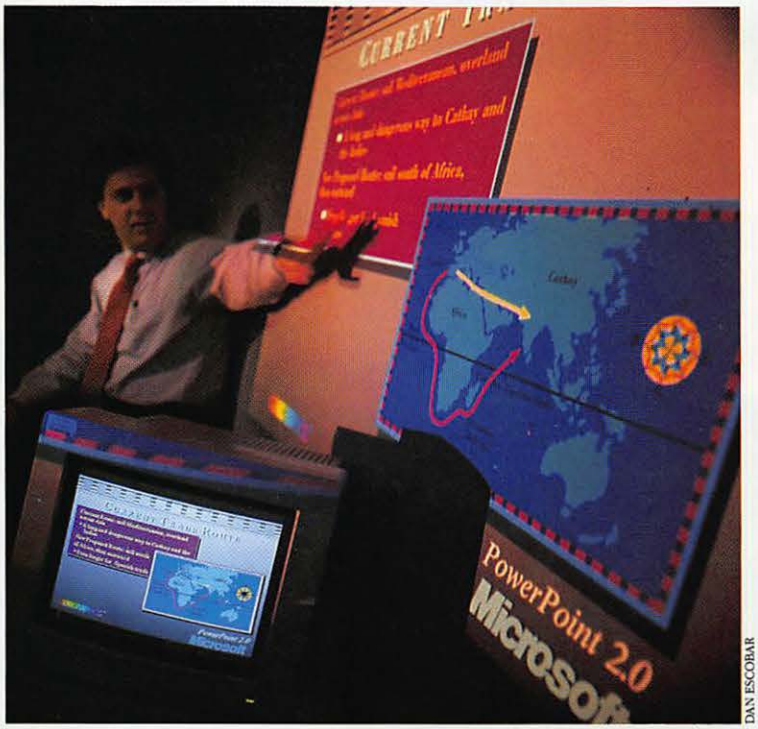
"But I have a Mac 512K or a Plus," you say. Don't worry—Olduvai Corporation's $129 ADBridge lets you connect to the new ADB devices, and it works the other way as well, allowing you to connect your old peripherals to the Mac SE or II.

Summagraphics and Kurta both offer ADB graphics tablets. Kurta's $395 IS/ADB Input System consists of an 8½-by-11-inch tablet and a pen or cursor device (both are available with cord or cordless). Summagraphics has announced the $495 Bit Pad Plus, a 12-by-12-inch tablet with a stylus and a 4-button cursor device.

If you prefer a trackball to the mouse, you have several options. Asher Engineering offers the Turbo Trackball for $119.95, Abaton's ProPoint optical trackball sells for $159.95, and Kensington Microware recently announced Turbo Mouse ADB for $169.95 (Kensington also offers a 7-foot ADB keyboard cable for $39.95).

For game fans, Advanced Gravis has announced an ADB-compatible joystick with a fire button at the tip and two mouse buttons on the base; it

(continues)



DAN ESCOBAR

PowerPoint's new on-screen color capabilities make possible both real-time presentations and sophisticated color slides.

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can also be used as a mouse replacement.

Perhaps you want to try a new technology altogether. Lightgate's $149 Felix is an input-and-pointing device that consists of a small handle that you hold like a pen and move within a 1-inch-square area. Unlike the mouse, Felix offers an optical tracking system, and absolute positioning.

Or, you could try a mouse that contains none of the moving parts that can gum up a mechanical mouse. The optical mouse, A+, from Mouse Systems, skims over a shiny metal pad that reflects a tiny beam of light as it tracks every hand movement.

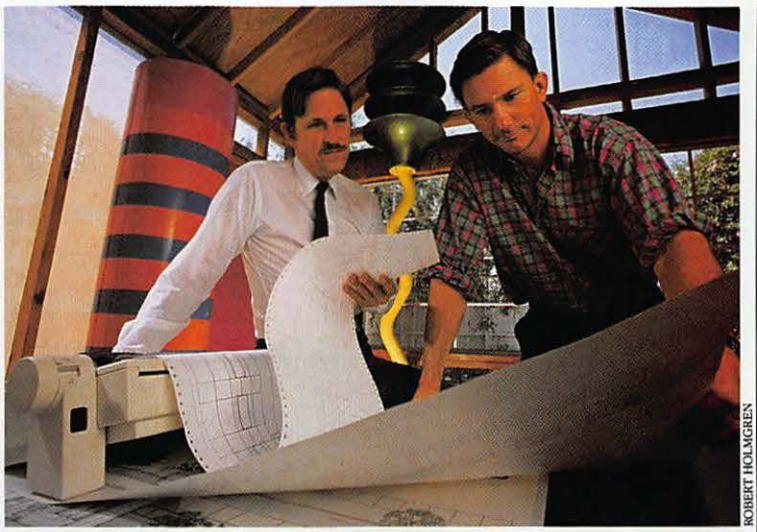
Finally, Personal Writer's handwriting-recognition system, Personal Writer 15S, which converts handwritten text and numbers to characters on the screen, is now ADB compatible. The grid-based Personal Writer 15S sells for $895; the Personal Writer 15SL, which allows you to write on unlined paper, costs $1795.



FRED STIMSON

ADB devices include trackballs and a wireless pen.

For further information, contact Abaton at 415/463-8822, Advanced Gravis at 800/663-8558, Asher Engineering at 818/960-4839, Kensington Microware at 212/475-5200, Kurta at 602/276-5533, Lightgate at 415/596-2350, Olduvai at 305/665-4665, Personal Writer at 800/322-4744, Summagraphics at 203/384-1344, and Mouse Systems at 408/988-0211.
–Erfert Fenton



ROBERT HOLMGREN

Frank Purtill and Wade Killfer of Carde/Killfer Architects in Santa Monica, California, examine computer-aided drawings printed by IDD's new Dreams program.

Easy CAD—a Reality

Dreams often set our mood for the day, and occasionally they reveal the future. Perhaps that's why Innovative Data Design (IDD), the publishers of the highly popular MacDraft, have called their next-generation CAD program Dreams.

Dreams is a very powerful program that's easy to use. For instance, you can specify the scale of your drawing in real-world terms. When you ask for an object's dimensions, Dreams calculates its actual size and displays it in the units you choose.

Other features include palettes that float above the document on a separate plane and are always active. Clicking on any of the palettes' tools gives you a menu of available options. Special editing tools allow rotation, gluing of edges, and merging of objects.

With Dreams you can draw using any of 16.8 million colors or 10 shades of laser-printer gray. The program generates color patterns using a 32-by-32-pixel tablet. The number of layers is restricted only by available memory. You can also take advantage of symbol libraries that will be commercially available, or create them using predrawn objects and text blocks.

Dreams helps define the Mac's long-term CAD future by supplying a "graphics engine" to which various capabilities are attached as modules. Using modules, both IDD and third-party developers can offer symbol libraries, integrated database functionality (for automatically generating proposals and reports from designs), and whole new programs.

Dreams is priced at $500. For more information, call IDD in Concord, California, at 415/680-6818.

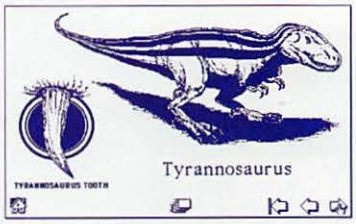
HYPERCARD

Hot Stacks

Today's emerging stacks seem to be either content-intensive or technique-intensive. Technique-intensive stacks work like mini-applications; a set of tools is offered to perform tasks. Content-intensive stacks work like mini-encyclopedias; authors cram the stacks full of information, and readers have it at their fingertips.

Two content-intensive stacks help you learn about Russian and dinosaurs. Dinosaurs are all the rage these days, and this stack has some great-looking beasts. Clicking on buttons provides the scientific details that everyone seems to forget. What this stack really needs is sound and animation. For example, HyperCard's magic could make a classic confrontation between *Triceratops* and *Tyrannosaurus rex* really come alive. The stack was produced by A. A. H. Computer Graphics Productions.

Another content stack is a set of Russian lessons, written by Martin P. Rice, which uses the somewhat uneven Macintalk voice synthesizer. Sections on grammar, vocabulary, reading, and exercises will have you saying *nyet* to IBM's offer of



Flying and ground-hugging dinosaurs inhabit this stack.

glasnost. Similar disks will cover other languages. HyperCard's format lends itself naturally to language lessons. A more technique-intensive stack is called Text File Importer/Exporter. It's a well-thought-out stack utility that provides a vehicle between ordinary text files (accessible from word processing programs) and the fields in HyperCard stacks. Unlike other text utilities, this one has user-defined options and built-in error checking. Written and very well documented by Allen G. Cecil.

You can probably obtain these public domain and share-

(continues)

Not just another pretty face



Sure, you're going to love the new look of Sigma Designs' LaserView Display System.

But the real beauty is in how well it handles your desktop publishing, spreadsheets and word processing.

Quite simply, LaserView offers the sharpest image anywhere: an eye-opening 1664 x 1200 (115 dpi) resolution for detail drawings, half-tone images, or even 6-point type. And an additional resolution mode of 832 x 600 for text-based work (for the Macintosh II and SE).

So what you'll get is the performance of a workstation in a PC environment. A full 19" monitor that's easy on the eyes, thanks to its high contrast screen; easy on the body because of its tilt/swivel base; and easy to work with, since you can view anything from a two-page spread to an engineering drawing.

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SIGMA DESIGNS

ware stacks very inexpensively from a local or national users group. For example, BMUG, one of the biggest groups, charges only $3 for its disks. (BMUG, 1442A Walnut St. #62, Berkeley, CA 94709.)—*Scott Kronick*

Objects in Space

If you need 3-D objects for animations, modeling, or illustrations, the Modeler by Mira Imaging may be for you.

It works like this. You set any small, nonmetallic object atop a special platform and "draw" a grid on the surface of the object with a pencil-like probe. Then you touch the probe to as many intersecting points as necessary to define the shape. As you draw, more and more triangles appear on the Mac's screen as points are connected to form a wire grid that approximates the object's actual shape.

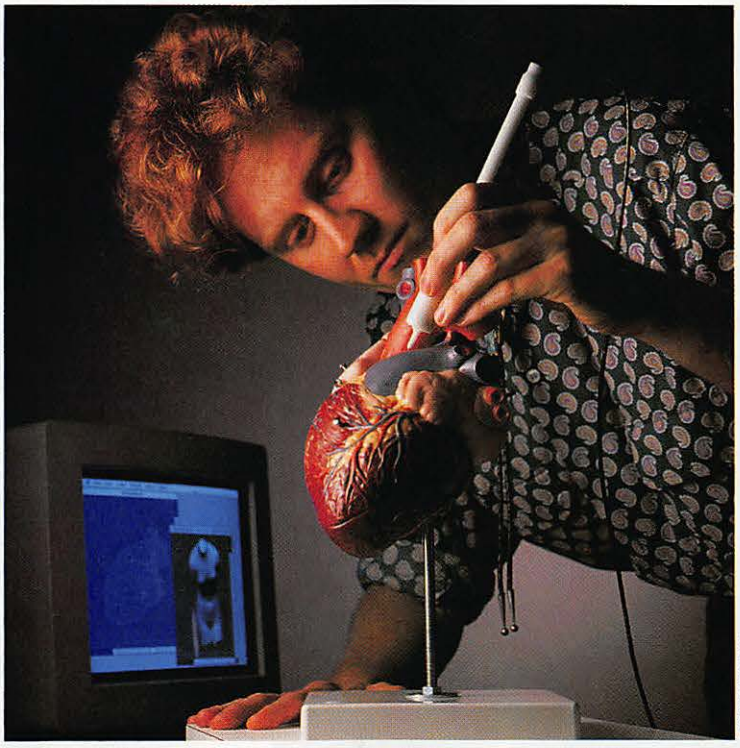


This three-dimensional image is composed of filled-in triangles that can be smoothed.

Once captured, this 3-D image can be moved and edited. For instance, ask for 3-D bezier curves, and you can push or pull on any point to modify the shape. And since you can view any curve from multiple angles, you can reshape the bow of a speedboat, for instance, while looking at cross-sectional, side, and bottom views.

The next step is to create a solid object by filling in all the triangles; then you use a smoothing tool to round out each flat triangle until the final image appears like a polished sculpture. Give the program another command and you can use the probe once again to view your creation from any angle and change the light source to emphasize important features. Once you're done, you can print the image using both PICT and PostScript. Images created on a Mac II can be saved in color PICT format for enhancement with a color paint program.

Prices begin at $5000 for the complete system including a McDonnell Douglas 3-D digitizer. For more information, call Mira Imaging in Toronto at 416/489-9247.



PAUL ORENSTEIN

Dan Donaldson uses Mira Imaging's 3-D probe, which images and rotates three-dimensional shapes, to define the surface of a heart model to a nearby Macintosh.

HYPERCARD

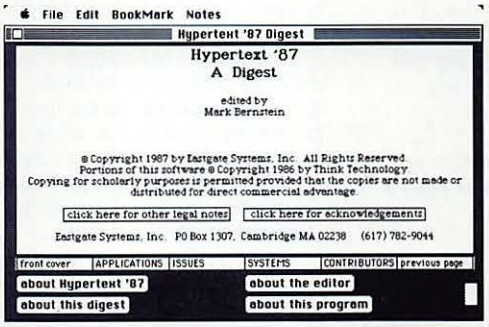
New Type of HyperCard?

When the word *hypertext* is mentioned, Apple's HyperCard usually springs to mind. A few will associate hypertext with OWL's Guide, a hypertext development tool that lets you jump around documents via buttons. But in fact there are at least nine hypertext products, some of which contain features and concepts that may be destined for future versions of HyperCard.

If you order a recently released $10 disk from Eastgate Systems, you'll discover a relatively unknown hypertext program called HyperGate, which functions somewhat like HyperCard's Browse mode. Once in HyperGate, you'll view selected quotes from last year's first-ever Hypertext Conference, which featured more than 180 presentations on the future of hypertext.

The disk, called the Hypertext '87 Digest, exemplifies many of the difficulties and promises of hypertext. Divided into Issues, Applications, Systems, and Contributors, the digest is hierarchically organized by buttons and is generously cross-referenced. The navigation aids keep the browser from getting lost in hyperspace, a common complaint about many hypertext systems. Although you can insert "bookmarks," add entries to the index, and make margin notes, you cannot create your own links. Unfortunately, embedded links are few and far between.

Although hypertext has a reputation for being all things to all people, the picture that emerges from the digest conveys the seriousness of the enterprise as well as enthusiasm for real-world projects such as the CD ROM version of *The Oxford English Dictionary.* To order, write Eastgate Systems, P.O. Box 1307, Cambridge, MA 02238.—*Richard Rawles*



Hidden inside this hypertext file are possible future HyperCard concepts and other "hyper" ideas discussed at a 1987 conference.

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Fonts for Display

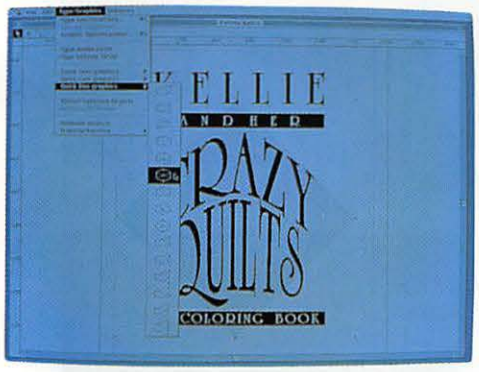
Designers will soon have a new set of tools at their disposal when Letraset ships a program, called LetraStudio, that is specially designed to handle display type in ways never before possible on the Mac.

For example, after typing out an advertising slogan and changing the type size to anything from 1 to 999 points (nearly 14 inches), you can choose from among a number of tools that distort or give perspective to the type. Select a tool, and a box with "handles" surrounds the slogan. Now click on any handle, move it, and the type moves too; you can slant it, change its height, and even flip it back on itself until it's upside down. Before Letraset, many of these tools were available only on much more expensive systems.

Other features enable you to edit fonts down to 1 pixel at a time, select half-tone templates, adjust letter or word spacing, vary the weight of strokes, fill a font or shadow with colors, use Pantone colors, and string text along the inside or outside of any polygon or bezier curve.

Another type-oriented product, Compugraphic's Font Manager, provides editable screen fonts in sizes ranging from 9 to 127 points. Basically, Font Manager brings a font factory to the Macintosh; it allows you to create any size font from any available font, no matter how many fonts are already in the System Folder.

Font Manager will ship by September, list at $100, and include four Compugraphic typefaces. LetraStudio will cost under $400, come with two typefaces, and ship by fall. For further information, call Letraset in Paramus, New Jersey, at 201/845-6100, and Compugraphic in Wilmington, Massachusetts, at 617/658-5600.

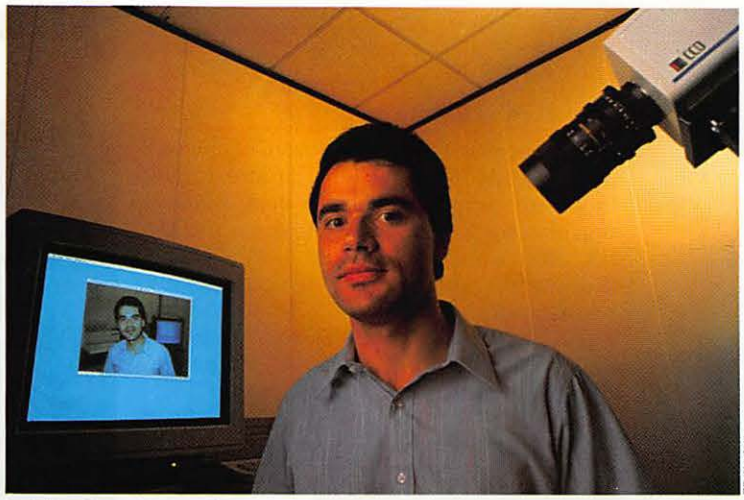


LetraStudio's specialty is creating headline-size display type using a host of graphic design tools, some of which wrap text around curves and circles.

Color DTP with Video

Imagine a client arriving with a videotape that contains color images that are to appear in a brochure. Using a special card in your Mac II, you capture the video images right off a VCR. (You can also use scanned color images from slides, photographs, paintings, or printed materials.)

You then open up PageMaker 3.0 to a previously prepared brochure layout. Within moments, you've placed the color images in your proposed brochure. Now you get down to finalizing the design using a 21-inch color monitor that displays two full-size pages. It's exciting work. Twenty-four–bit color —with its 16.8 million available hues—gives you images of photographic quality. You see everything just as it will appear in print.



ED KASHI

Michael Maietta of RasterOps demonstrates his company's FrameGrabber card, which captures video images for DTP.

All this is now possible using a new 24-bit color FrameGrabber card from RasterOps. The FrameGrabber can store in memory any picture that appears in one of two formats: standard American television (NTSC) and red-green-blue (RGB).

Your 21-inch, high-resolution video screen is driven by the ColorBoard 244. This card supports monitors capable of resolving 1280 by 1024 pixels with 24-bit color using the Mac's standard full-size 72-dpi resolution. In addition, you can automatically pan across a much larger virtual screen: up to 2048 by 1024 pixels.

Should you want to try animations, the ColorBoard 244 includes an 8-bit Alpha channel that lets you move colored objects in front of a 24-bit image. Each movement can be recorded as a single frame and a series can be played back as a movie using a frame recorder.

As of press time, RasterOps was the only manufacturer delivering 24-bit color video cards to end-users. All other video cards for the Mac II are limited to 8 bits, or 256 colors. For further information, call RasterOps in Cupertino, California, at 408/446-4090.

HYPERCARD

Reports for HyperCard

Although sensational for inputting and viewing different kinds of data, HyperCard can print information only in a card format as pictured on screen. What's missing is the ability to print a list of all names appearing on all cards, for example. Coming to the rescue is Activision's Reports, which turns HyperCard into a powerful relational database with full report-generation capabilities, including full-page printouts.

To get an idea of how Reports works, consider a check-writing program created in HyperCard. Without Reports, you can print only the stack's cards, which in this case are likely to be just a series of checks. But with Reports you can sort financial records alphabetically, numerically, or by date, using up to 15 selection criteria. For instance, you can select checks from a certain time period, or checks relating only to utility costs, car payments, or food expenses. Then you can arrange this information in columns, add a heading and footer, and print the sorted material.

(continues)

Macintosh Accessories

Mac II Workstation

Everyone who needs the power of the Mac II also needs the space that the Monitor and Processor occupy. With no desk space to organize work and lay out projects, the Mac II's effectiveness is limited. The Mac II Workstation takes a totally new approach to workstation ergonomics. It provides a unique arm suspension system and shelf area giving the operator the ultimate in adjustability and space savings.

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MacTilt SE

The Mac SE sitting on the desk leaves the screen too low for comfortable operation. MacTilt SE elevates the Mac 4" and provides 30° tilt and 360° rotation for better viewing and greater operator comfort.

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Mouse Cleaner 360°

By regularly cleaning your Mouse, you can eliminate sluggish operation and expensive repair bills. By removing the grime from the tracking rollers, free cursor movement is quickly restored. Compatible with Macintosh, IBM, and any Mouse using either a 7/8" or 1" positioning ball.

$16.95

MacTilt for Mac II & Large Screens

The same outstanding features and user benefits of the MacTilt SE are now available for your Large Screen Display or Mac II Monitor. Call for specific models.

$89.95 - $99.95

The Muzzle

The Muzzle protects your confidential files, documents, and software on your hard drive by preventing the Mac SE from being powered up. Models are also available which allow operation of the Mac SE, yet prevent access to the 3.5" disk drive for showroom and software demonstrations. **$69.95**

Mac Extension Cables

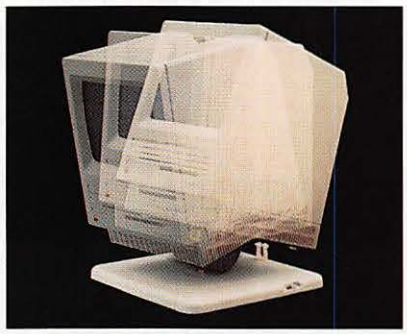
Ergotron's Extension Cables allow the user to position the Monitor or Keyboard up to 8' away from the Macintosh SE or Mac II.

$30.00-$45.00

Ergotron Accessories are available at your local Apple Dealer or Distributor including Bonsu, Micro D, and Ingram. In Canada contact Softcode.

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Circle 148 on reader service card

Reports also brings you calculated fields and five levels of sorting. You can relate information from multiple stacks, use any combination of font sizes and styles, include graphics, do mail merge with automatic formatting, and order chained reports for unattended printing.

In fact, Reports is so powerful that Activision expects many software developers and shareware authors to use a run-time version within their own HyperCard-based applications. For instance, a complicated accounting system written in HyperCard could have all printing handled by Reports. Users probably wouldn't know Reports was at work nor would they mind paying the pennies Activision expects to charge for each copy of run-time Reports. As an application, Reports lists for $99. For more information, call Activision in Mountain View, California, at 415/960-0518.

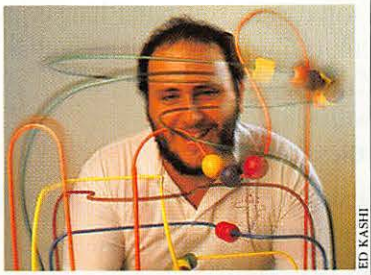
Programming Secrets

If you want to learn how to program the Macintosh, the first thing you need to do is distinguish among the Scott K's. There's a Kronick (that's me), a Knaster (whose book is being reviewed here), and a Kamins (who wrote manuals for Apple). These three Scotts do little else but write about Macintosh programming.

The rules for distinguishing among the three Scotts are simple:

To begin learning how to program in Pascal or MPW assembly, you read Kronick. If you're already an accomplished programmer and you want to know why your programs still don't run worth a darn, you read Knaster. If you know everything in Kronick's and Knaster's books, you read Kamins to determine if you want a job writing code for Apple.

Knaster's second book, *Macintosh Programming Secrets* (Addison-Wesley, 1987), continues where his first book, *How to Write Macintosh Software* (Hayden Books/Howard W. Sams, 1986), left off. In it, he explores the common problem areas of experienced Macintosh programmers.



ED KASHI

Scott Knaster's programming books are well known among professional Mac programmers.

Don't be misled by the simple names of Knaster's books. They do not offer introductory material or language tutorials of any sort. This is precisely the value of Knaster's contribution: his books really help professional programmers solve problems specific to the Macintosh.

Knaster has lots of experience with third-party developers' questions, and he addresses issues confidently and fluidly. He offers sometimes-irreverent explanations of design decisions, which makes reading the technical material more fun.

Final note: Addison-Wesley and Hayden Books/Howard W. Sams deserve mention for the high quality of their books. They use clean white paper, firm bindings, and sharp covers. They're a refreshing contrast to the companies that make ugly books with brownish paper rough enough to give splinters.—*Scott Kronick*

Making Slides Easy

Options that let the Mac user create business presentation slides are multiplying. Three new film recorders—Matrix Computer Graphics' ProColor, Mirus Corporation's FilmPrinter, and LaserGraphics' Personal Film Recorder—have joined Presentation Technologies' ImageMaker, which has had the Mac market largely to itself.

At 8000 lines per inch, ImageMaker has the highest degree of text resolution available because it uses fully formed letters, a technology similar to that used in daisy wheel printers. That technology also limits the product, as the Mac community is used to having WYSIWYG output without the daisy wheel's restrictions as to number, size, or style of fonts (each new size or style of font requires a new daisy wheel). Priced at less than $5000, ImageMaker works with most software and all Macs.

In the same price range is LaserGraphics' Personal Film Recorder, which works with any Mac and most software. It offers only 4000- and 2000-line resolution but greater speed. In addition to the standard 35mm film camera, there's a Polaroid camera available for proofing.

More expensive ($6995), but claiming a superior image, is Matrix's ProColor. This recorder should be available in September, for the Mac II only. It will be compatible with any software that supports the PICT file format and will have a resolution of 4096 lines.

Mirus's FilmPrinter, priced at about $6000, supports 35 LaserWriter fonts in any size and 16 million colors. Resolution is up to 8000 lines per inch.

For those who can't justify the cost of one of these units, a slide production service remains a viable alternative. For further information, call Presentation Technologies in Sunnyvale, California, at 408/749-1959; LaserGraphics in Irvine, California, at 714/660-9497; Matrix Computer Graphics in Orangeburg, New York, at 914/365-0190; and Mirus Corporation in Los Altos, California, at 415/949-5544.—*Scott Beamer*



FRED STIMSON

Film recorders like LaserGraphics' PFR, Matrix's ProColor, and Presentation Technologies' ImageMaker Plus (left to right) bring new color capability to the Mac.

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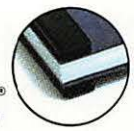
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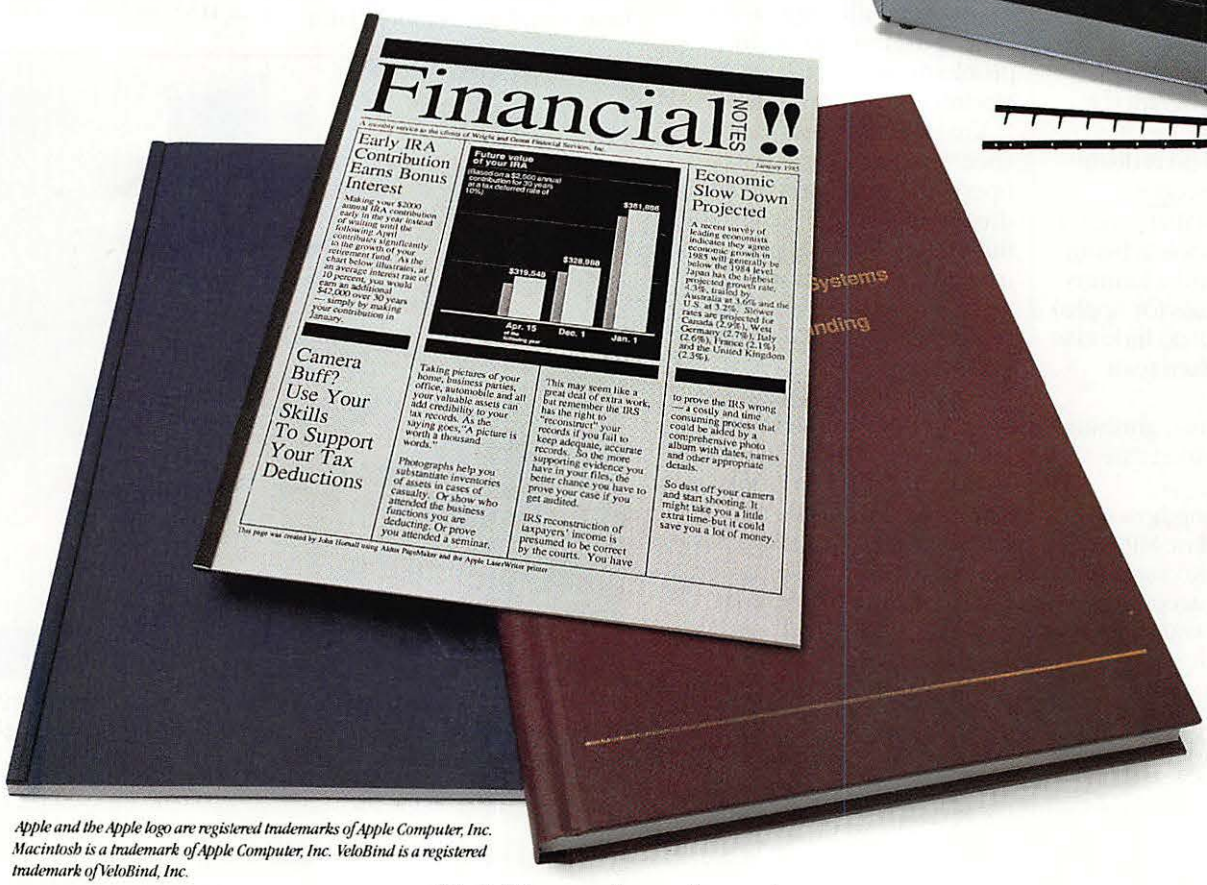


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Circle 27 on reader service card

High-End CAD

Question: What CAD software has 150,000 users on Suns, Apollos, DECs, IBMs, and clones, and will soon run on a 4MB–8MB Macintosh II with full file-interchangeability among all? Answer: AutoCAD version 10, with 3-D wire-frame functionality, surface modeling, 41 third-party software products, and a price tag of $3000.

First shown publicly at A/E/C Systems '88 as a Mac port from the MS-DOS version, its user interface and operation will appeal mostly to present AutoCAD users. Unless the final released version becomes more Mac-like, Mac II users will find that it doesn't take advantage of Mac capabilities that they take for granted, including copying and pasting from the Clipboard into AutoCAD, multiple windows and multiple screens, Mac fonts and fill patterns, and on-screen icons instead of text menus. Autodesk says its first release of AutoCAD has some basic Mac functionality; next year's version will have much more Mac compatibility. No performance comparisons are available yet, but the Mac version—4MB RAM resident—may prove to be faster than the MS-DOS version, which requires frequent disk accesses.

AutoCAD's 3-D capabilities extend its 2-D drawing tools. When you have selected a construction plane in 3-D space, the AutoCAD drawing tools enable you to create 3-D wire frames on that plane. You can create 3-D surfaces by rotating simple or complex lines; by using 3-D polylines, 3-D meshes, tabulated cylinders, or ruled surfaces; or by defining Coon's surfaces (surface patches). Dynamic viewing allows rotation of a 3-D model in real time. Also available is a choice of parallel or perspective projection, as well as dynamic pan and zoom. You can display 3-D images from one of 16 viewpoints.

The Mac version of AutoCAD will support AutoLISP (a programming language for creating macros) without the severe 640K memory limitations of MS-DOS machines. Users will be able to customize menus to meet their needs, and objects in a drawing can be included in a database automatically.

The availability of AutoCAD and third-party products firmly establishes the Mac II as a viable CAD platform for even the most demanding user. It also opens up the Mac to a host of specialized applications previously unreachable with Mac mechanical and AEC CAD software. Such applications include parametric drafting, piping, chemical engineering, mapping, and new areas in computer-aided manufacturing and structural and civil engineering. Release 10 will output to both laser printers and industry-standard plotters.

Autodesk will have version 10 available by September this year. In a unique upgrade offer, the company may prompt a user exodus to Macs. When upgrading from version 9 for $250, current AutoCAD users will be given a choice of switching platforms and receiving the Macintosh version. For further information, call Autodesk in Sausalito, California, at 415/331-8093.—*David Peltz*



DAN ESCOBAR

AutoCAD for the Mac creates many kinds of 3-D images.



VAL FLESH

Bill Atkinson (left) shares the second annual Andrew Fluegelman Award with PageMaker developers Jeremy Jaech, Ted Johnson, and Clyde McQueen (right). PCW Communications chair David Bunnell presents the award.

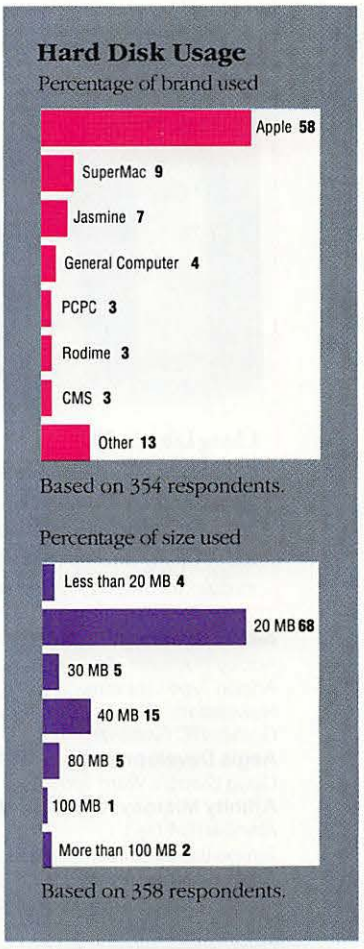
Macworld News: Readers' Views

This month's reader survey focuses on brands and storage capacities of hard disks. We received 537 reponses from a survey sent to 1000 randomly selected *Macworld* readers. Of those, slightly over two-thirds, 68.7 percent, use a hard disk with their Mac.

Not surprisingly, the favorite brand was Apple, with 58 percent usage, followed by SuperMac and Jasmine with 9 and 7 percent, respectively.

The most popular drive size was 20 megabytes, 68 percent usage; 40MB drives scored 15 percent usage. Only 4 percent of the respondents preferred hard disks with less than 20MB. Respondents split about evenly between internal and external mounting (48 and 52 percent, respectively).

If you're curious about your fellow readers' Mac habits, send your suggested questions to News Editor, *Macworld,* 501 Second St., San Francisco, CA 94107.



Apple takes the lion's share of the Macintosh hard-disk market, while other suppliers compete for what's left.

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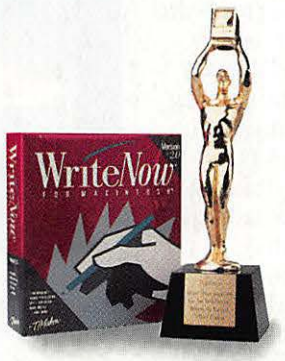
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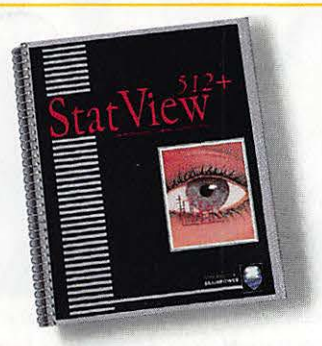
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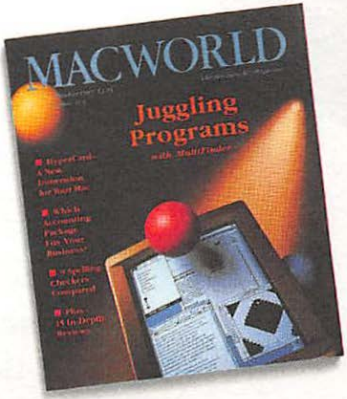
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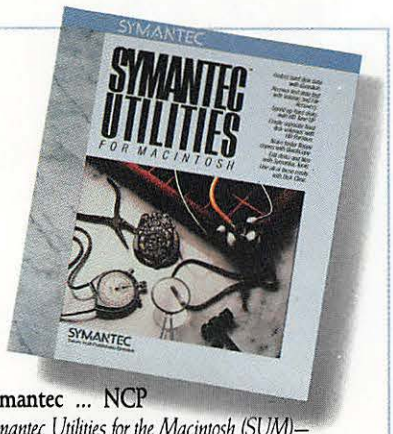
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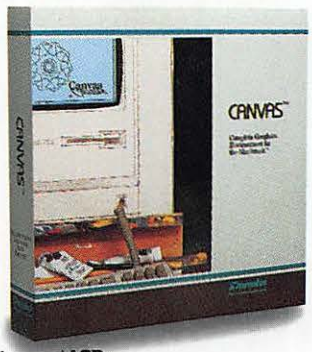
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MacSQZ! *(use w/Microsoft Excel)* . . . . . 49.
Symmetry ... NCP
Acta *(outline/writing desk accessory)* . . . . . 36.
HyperDA *(access HyperCard stacks)* . . . . . 38.
PictureBase *(clip art manager, 512k)* . . . . . 58.
3G Graphics ... NCP
Images with Impact *(PostScript™ clip-art)* . . 59.
Telegraphics ... NCP
HyperTutor *(HyperTalk tutorial)* . . . . . 30.
Think Educational ... CP
MacEdge II or Mind Over Mac . . . . . 28.
T/Maker ... NCP
ClickArt Personal Graphics, Effects, Publications, Letters Vol. 1 or 2, Holidays, Business Images . . . . . *each* 28.
Christian Images . . . . . 35.
Bombay, Plymouth, or Seville Laser font . . . 45.
EPS Illustrations *(over 3 Meg's worth)* . . . . . 75.
Write Now *(word processor w/spell checker)* 98.
TOPS ... CP
TOPS Teleconnector *(DIN8 or DB9)* . . . . . 39.
TOPS *(file-server/LAN software)* . . . . . 119.
TOPS Repeater . . . . . 132.



Deneba ... NCP
Canvas—Incorporate object-oriented and bit-mapped graphics in the same layer. Buy now and get a free upgrade to version 2.0 (a $100 value). . . . . $109.

Traveling Software ... NCP
LAP-LINK Mac *(connect Mac to IBM-PC)* . . 85.
True BASIC ... NCP
LANGUAGE & TOOLKITS
True BASIC *(interpreter & compiler)* . . . . . 59.
3D Graphics, Sorting & Searching, Advanced String, Business Graphics, Scientific Graphics or Mathematicians Toolkit . . . . . *each* 49.
EDUCATIONAL SOFTWARE
Algebra I or II, Pre-Calculus, Trigonometry, Discrete Math, Probability, Calculus, Arithmetic & MacFunction . . . . . *each* 35.
TrueSTAT *(statistics)* . . . . . 49.
Unicorn ... CP
Animal Kingdom *(ages 6-12)* . . . . . 27.
Math Wizard *(math games, ages 5-10)* . . . . 27.
Read-A-Rama *(reading, ages 5-8)* . . . . . 32.
William & Macias ... NCP
DiskFinder *(DA disk catalog)* . . . . . 29.
myDiskLabeler w/Color *(req. ImageWriter II)* 31.
myDiskLabeler w/LaserWriter option . . . . . 34.
WordPerfect ... NCP
WordPerfect Mac *(word processor)* . . . . . 185.
Working Software ... NCP
Lookup *(90,000 word dictionary)* . . . . . $29.
Findswell *(locate documents fast)* . . . . . 29.
Spellswell *(spelling checker)* . . . . . 42.
Spellswell Legal or Medical Dictionary . . . . 54.

GAMES

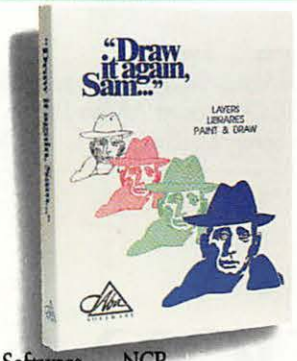
Accolade ... CP
Hardball *(baseball simulation)* . . . . . 23.
Activision ... CP
Shanghai *(Mah Jongg strategy)* . . . . . 24.
Addison-Wesley ... CP
Puppy Love *(you and your dog will love it!)* 19.
Avalon Hill ... CP
MacPro Football *(req. 1 Meg)* . . . . . 28.
Baudville ... CP
Guitar Wizard *(learning tool for guitar)* . . . . 22.
Ted Bear's Rainy Day Games . . . . . 22.
Blue Chip ... CP
Millionaire *(stock market simulation)* . . . . . 35.
Broderbund Software ... CP
Lode Runner or Ultima III . . . . . 24.
Ancient Art of War *(military strategy)* . . . . . 27.
Toy Shop *(create working models)* . . . . . 30.
Bullseye ... CP
Ferrari Grand Prix or Fokker TriPlane . . . . . 32.
Electronic Arts ... CP
Skyfox, Pinball Construction Set, Dr J vs Larry Bird . . . . . *each* 15.
Ogre *(tank simulation)* . . . . . 20.
Patton vs Rommel or Scrabble . . . . . 27.
Chessmaster 2000 . . . . . 28.
Epyx ... CP
Sub Battle Simulator *(NCP)* . . . . . 24.
Winter Games *(Olympic events)* . . . . . 24.
Greene, Inc. ... CP
Crystal Quest *(top-rated color arcade)* . . . . 24.
Hayden Software ... CP
Sargon III *(9 levels of chess)* . . . . . 29.
Infinity Software ... CP
Go or Grand Slam Tennis . . . . . 27.
Infocom ... CP
Leather Goddesses, Bureaucracy, Borderzone, Lurking Horror . . . . . *each* 24.
Beyond Zork . . . . . 30.
Classic Mystery Library: Moonmist, Suspect, & Witness . . . . . 36.



Personal Computer Peripherals ... 2 years
MacBottom—High performance hard drives (21, 32, 45, or 70 Meg) with optional built-in modem. Formatted & ready to plug in. Includes spooler, back-up, & other utilities. . . **see listing**

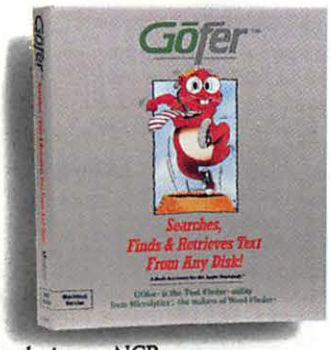
Get it tomorrow.

ConcertWare+ *(music composition)* . . . . . $39.
ConcertWare+ MIDI . . . . . 79.
Greene, Inc. ... NCP
QuickDEX *(address book)* . . . . . 32.
Hayden Software ... CP
Score Improvement for the SAT . . . . . 58.
Hayes ... NCP
Smartcom II *(communications)* . . . . . 88.
Ideaform ... NCP
MacLabeler or DiskQuick . . . . . 27.
HyperBook Maker *(print stacks into book)* . . 31.
Imagine ... NCP
Smart Alarms *(DA reminder system)* . . . . . 35.
Multi-user Appointment Diary . . . . . 85.
Infosphere ... CP
LaserServe *(network software)* . . . . . 62.
ComServe *(NCP, modem sharer)* . . . . . 124.
MacServe *(network software)* . . . . . 158.
Innovative Data Design ... NCP
MacDraft *(object-oriented graphics)* . . . . . 149.
Intuit ... NCP
Quicken *(personal accounting)* . . . . . 35.
Kent Marsh Ltd.
The NightWatch *(hard disk security)* . . . . . 89.
MacSafe *(advanced security program)* . . . . 89.
LaserWare ... NCP
LaserPaint Color II *(256 gray scales)* . . . . . 379.
Layered ... CP
Notes for...Excel, Works or Word . . . . . 40.
Learning Company ... CP
Reader Rabbit *(ages 4-7)* . . . . . 33.
Letraset ... NCP
Image Studio or Ready,Set,Go!4 . . . . . 279.
Linguist's Software ... NCP
Tech *(1000 different symbols)* . . . . . 59.
LaserTech . . . . . 79.
FOREIGN LANGUAGE FONTS
SuperFrench/German/Spanish . . . . . 39.
MacKana/Basic Kanji . . . . . 39.
MacHebrew, MacKanji, MacKorean, MacThai, MacGreek, MacCyrillic . . . . . *each* 59.
MacHebrew Scriptures . . . . . 79.
MacGreek New or Old Testament . . . . . 79.
MacChinese *(supplements available)* . . . . . 79.
MacGreek/Hebrew/Phonetics . . . . . 89.
FOREIGN LANGUAGE LASER FONTS
LaserFrench/German/Spanish . . . . . 79.
LaserGreek or LaserHebrew . . . . . 79.



Aba Software ... NCP
"Draw it again, Sam"—Object-oriented drawing program with ten layered drawing planes. Produce color separations or cell animation. Includes graphic library . . . . . $89.

Lundeen & Associates ... NCP
WorksPlus Spell *(spell checker for Works)* . . $46.
WorksPlus Command *(macros for Works)* . . 60.
MacroMind ... NCP
VideoWorks II *(animation tool)* . . . . . 118.
VideoWorks II Accelerator or Driver for HyperCard . . . . . 61.
MacroPac International ... NCP
101 Macros for Excel . . . . . 44.
Manhattan Graphics ... NCP
Ready,Set,Show *(presentations)* . . . . . 289.
MECA ... NCP
Managing Your Money *(finance)* . . . . . 129.
Microlytics ... NCP
Word Finder *(synonym finder)* . . . . . 35.
GOfer *(text finder)* . . . . . 45.
Microseeds Publishing ... NCP
Redux *(fast & easy backup utility)* . . . . . 65.
Microsoft ... NCP
Basic Interpreter 3.0 . . . . . 62.
Chart 1.02 *(42 chart styles, CP)* . . . . . 79.
Microsoft Write 1.0 *(w/spell checker)* . . . . . 113.
Multiplan 1.1 . . . . . 119.
File 1.05 . . . . . 119.



Microlytics ... NCP
GOfer—Where's that letter? Which memo mentioned coffee breaks? Find them fast! GOfer quickly searches all your text tiles for keywords & tells you what's buried where $45.

Basic Compiler 1.0 . . . . . 125.
Fortran 2.2 *(compiler)* . . . . . 189.
Works 1.1 *(integrated tool)* . . . . . 189.
Microsoft Mail *(up to four users)* . . . . . 195.
Microsoft Mail *(up to 10 users)* . . . . . 325.
Microsoft Mail *(up to 20 users)* . . . . . 499.
Excel 1.06 *(power spreadsheet)* . . . . . 249.
Word 3.02 *(powerful word processor)* . . . . 249.
PowerPoint 2.0 *(presentations)* . . . . . 249.
Migent ... NCP
In House Accountant *(small business)* . . . . 119.
Miles Computing ... NCP
Orchestra of Fonts Vol. 4 . . . . . special 19.
Mac the Ripper Vol. 3 *(req. Paint program)* . . 27.
Peoples, Places & Things Vol. 5 . . . . . 27.
Mindscape ... NCP
The Perfect Score: SAT *(CP)* . . . . . 46.
ComicWorks *(create your own comics)* . . . . 47.
GraphicWorks *(newsletters & posters)* . . . . . 84.
Monogram ... NCP
Dollars & Sense *(home, small business)* . . . . 81.
Business Sense *(full-featured)* . . . . . 279.
Nantucket ... NCP
McMax *(dBASE III compatible)* . . . . . 175.



Enzan-Hoshigumi ... NCP
MacCalligraphy—The cultural scripting of the East comes to your Mac. Helps you picture your words in a thousand ways. Includes Japanese clip-art . . . . . $109.

Nashoba Systems ... NCP
FileMaker Plus *(feature-packed database)* 149.
Nolo Press ... NCP
WillMaker 3.0 *(prepare your own will)* . . . . . 35.
North Edge Software ... NCP
Timeslips III *(time & expense tracking)* . . . . 119.
Odesta ... NCP
GeoQuery *(geographical database)* . . . . . 299.
Double Helix II *(relational, custom menus)* 339.
Olduvai Software ... NCP
DA-Switcher *(unlimited desk accessories)* . . 25.
Post ART *(clip art, 3 disk set)* . . . . . 35.
Icon-It! *(create custom icon bars)* . . . . . 39.
FontShare *(share PostScript™ fonts)* . . . . . 149.
Read-It!TS *(OCR software for Thunderscan)* 79.
Read-It! *(300 dpi OCR software)* . . . . . 199.
OWL International ... NCP
Guide 2.0 *(hypertext, free-form info)* . . . . . 119.
Palantir ... NCP
MacType *(typing instruction)* . . . . . 31.
inTalk *(communication to emulation)* . . . . . 119.
Passport Designs ... CP
Mastertracks Jr. . . . . 109.
Mastertracks Pro *(music editor)* . . . . . 259.
Peripherals Computers & Supplies ... NCP
KaleidaGraph *(data analysis & graphics)* . . 125.
VersaTerm *(terminal emulator/comm.)* . . . . 135.
VersaTerm-PRO *(powerful terminal prog.)* . . 199.
Personal Computer Peripherals ... NCP
HFS Backup . . . . . 28.
Postcraft International ... NCP
Laser FX *(PostScript™ fonts special effects)* . 115.
ProVUE Development ... NCP
OverVUE *(power-packed database)* . . . . . 149.
Rubicon Publishing ... CP
Dinner At Eight-Encore Edition Bundle . . . . 51.
Satori ... NCP
BulkMailer 3.2 *(mailing lists)* . . . . . 79.
BulkMailer Plus *(up to 90,000 names)* . . . . 195.
Legal Billing *(attorneys to accountants)* . . . 369.
Project Billing *(architects to engineers)* . . . . 439.
Sensible Software ... NCP
Sensible Grammar . . . . . 55.
Silicon Beach Software ... NCP
Silicon Press *(printer utility, 512k)* . . . . . 41.
World Builder *(program creator)* . . . . . 41.
SuperPaint *(advanced graphics program)* . . 79.
Super3D *(3D modeling & animation)* . . . . . 159.

What's hot & co

Science Fiction Classics: Hitchhiker's, Planetfall, & A Mind Forever Voyaging . . . $36.
Zork Trilogy . . . . . 42.

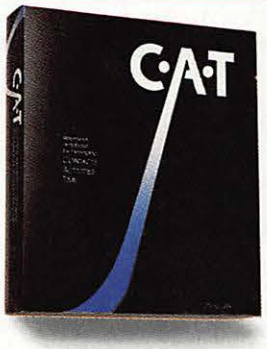
MacroMind ... NCP
Mazewars+ *(play via modem or network)* . . 31.

Microsoft ... CP
Flight Simulator *(the Mac takes flight)* . . . . 32.

Micro Sports ... NCP
MSFL Pro League Football . . . . . 32.

Miles Computing ... CP
Down Hill Racer *(3D ski simulation)* . . . . . 24.
Harrier Strike Mission II . . . . . 27.
Fool's Errand *(puzzles, mazes and more)* . . 27.

Mindscape ... CP
Trust & Betrayal: The Legacy of Siboot, Crossword Magic, Balance of Power, Deja Vu, Shadowgate, Uninvited . . . . . *each* 30.



Chang Labs ... 5 years
C.A.T.—Powerful relational database for managing Contacts, Activities, and Time. Use to organize events, meetings, day-to-day projects, expense reports, personnel records, etc. **$239.**

Olduvai Software ... NCP
Maze Survival *(action game)* . . . . . 21.

PBI Software ... CP
Strategic Conquest *(multi-user)* . . . . . 35.

Primera Software ... CP
Smash Hit Racquetball II . . . . . 22.

Psion ... CP
Psion Chess *(3D and multi-lingual)* . . . . . 31.

Sierra On-Line ... CP
Leisure Suit Larry *(swinging single life)* . . . . 23.
King's Quest I, II, or III . . . . . 30.
Space Quest *(save the universe!)* . . . . . 30.

Silicon Beach Software ... NCP
Airborne! *(CP, digitized sounds)* . . . . . 20.
Enchanted Scepters *(CP, over 200 scenes)* 21.
Dark Castle *(top-rated arcade action)* . . . . 27.
Beyond Dark Castle *(super sequel)* . . . . . 27.
Apache Strike *(3D helicopter action)* . . . . $27.

Simon & Schuster ... CP
Star Trek—The Kobayashi Adventure . . . . . 24.
Promethian Prophecy . . . . . 24.

Sir-Tech ... CP
Mac Wizardry *(high-rated fantasy)* . . . . . 35.

SPHERE, Inc. ... NCP
PT-109 *(torpedo boat simulation)* . . . . . 26.
GATO *(submarine simulator)* . . . . . 26.
Orbiter *(space shuttle simulation)* . . . . . 26.
Falcon *(F-16 flight simulation)* . . . . . 26.

XOR ... NCP
Pro Challenge *(football)* . . . . . 30.
NFL Challenge *(w/illustrated handbook)* . . . 64.

HARDWARE

Manufacturer's minimum limited warranty period is listed after each company name. Some products in their line may have longer warranty periods.

1 Meg SIMMs . . . . . *call for availability.*

Abaton ... lifetime
ProPoint ADB for Mac SE or II . . . . . 117.

Asher Engineering ... Lifetime
Turbo Trackball *(specify Mac)* . . . . . 79.

AST Research ... 6 months
Mac 286 *(MS-DOS on your Mac II)* . . . . . call
AST TurboScan *(300 dpi scanner)* . . . . . call
AST TurboScan *(flatbed scanner)* . . . . . call
AST TurboLaser P/S . . . . . call

Curtis Manufacturing ... lifetime
SURGE SUPPRESSORS
Safestrip *(6 outlets)* . . . . . 21.
Diamond *(6 outlets)* . . . . . 32.
Emerald *(6 outlets; 6 ft cord)* . . . . . 36.
Sapphire *(3 outlets; EMI/RFI filtered)* . . . . . 47.
Ruby *(6 outlets; EMI/RFI filtered; 6 ft cord)* . 59.

Datadesk ... 2 years
MAC-101 *(high-performance keyboards for the Mac 512, Plus, SE or II)* . . . . . *each* 139.
HyperDialer *(auto-dial for Mac & HyperCard)* 26.

Dove Computer ... 90 days
Toolkit *(clamp, torx driver & wrist strap)* . . . . 15.
SCSI Interface/Port . . . . . 85.
MacSnap 524E *(512E to 1 Meg)* . . . . . 195.
MacSnap 524 *(512k to 1 Meg)* . . . . . 195.
MacSnap 524S *(512E to 1 Meg w/SCSI)* . . . 219.
MacSnap 548E *(512E to 2 Meg)* . . . . . 389.
MacSnap 548 *(512k to 2 Meg)* . . . . . 399.
MacSnap 548S *(512E to 2 Meg w/SCSI)* . . 479.
MacSnap 2S *(1 Meg to 2.5 Meg)* . . . . . call
MacSnap 2SE *(Mac SE to 2 Meg)* . . . . . 299.
MacSnap 4S *(1 Meg to 4 Meg)* . . . . . call
MacSnap 8S *(for Mac II, to 8 Meg)* . . . . . call
MacSnap Plus 2 *(MacPlus to 2 Meg)* . . . . . 299.
MacSnap Plus 2H *(MacPlus to 2.5 Meg)* call
MacSnap Plus 4H *(Plus/II to 4 Meg)* . . . . . call

68020 ACCELERATOR BOARDS FOR MAC SE
Model MSE 1 *(16 MHz, 0 Meg of memory)* 585.
Model MSE 2 *(MSE 1 with 1 Meg)* . . . . . 779.
Model MSE 3 *(MSE 1 w/math co-processor)* 779.
Model MSE 4 *(MSE 1 with 1 Meg & math co-processor)* . . . . . 975.
1024 Option *(1 Meg accelerator or Mac II memory expansion)* . . . . . 299.
Math Kit *(math co-processor chip set)* . . . . 225.

Ergotron ... 1 year
Mouse Cleaner 360° . . . . . 15.
MacTilt or MacTilt SE . . . . . 68.
MacTilt *(for large monitor)* . . . . . 85.

Farallon Computing ... 1 year
PhoneNET-AppleTalk 120 . . . . . 9.
PhoneNET PLUS *(DB-9 or DIN-8)* . . . . . 36.
PhoneNET StarController™ . . . . . 1395.
PhoneNET Punch Down Block Wire Kit . . . 69.
TrafficWatch *(monitor network)* . . . . . 159.

Hayes ... 2 years
Smartmodem 1200 . . . . . 299.
Smartmodem 2400 . . . . . 449.
MacPlus/SE/II 1200 or 2400 Package . . . . call

Kensington ... 1 year
Mouseway *(mouse pad)* . . . . . 8.
Mouse Pocket *(ADB)* . . . . . 8.
Mac Plus/Mac SE Cover . . . . . 9.
Printer Stand . . . . . 16.
Disk Drive Cleaning Kit . . . . . 20.
Macintosh II Stand . . . . . 20.
Universal Copy Stand . . . . . 22.
Extra Long ADB Keyboard Cable . . . . . 25.



Kensington ... 1 year
New Turbo Mouse—Twice the speed in half the space. 200 CPI precision. Advanced button features. Specify MacPlus, SE, or II. . . . . **$109.**

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ol for your Mac.

Anti-glare Filter *(for MacPlus or SE)* . . . . . $33.
Macintosh II Monitor Cable . . . . . 33.
Apple Security System. . . . . 34.
SuperBase *(tilt/swivel & shelf)*. . . . . 35.
Printer Muffler *(80 column)*. . . . . 43.
Printer Muffler *(132 column)*. . . . . 58.
Printer Muffler Stand *(80 column)*. . . . . 25.
MasterPiece 400 . . . . . 64.
MasterPiece Mac II . . . . . 105.
A-B Box *(mini DIN-8)* . . . . . 64.
System Saver Mac. . . . . 64.
Turbo Mouse *(specify MacPlus, SE or II)*. . 109.

Koala Technologies ... 90 days
MacVision 1.4 *(digitizer)*. . . . . 169.

Kraft Systems ... 1 year
3-Button QuickStick *(specify Mac)* . . . . . 39.

Kurta ... Lifetime
IS ADB Tablet *(graphics tablet)*. . . . . 259.
Cordless 4 Button Cursor . . . . . 99.

Migent ... 1 year
Pocket Modem *(ext. 300/1200 baud)* . . . . 115.

MSC Technologies ... lifetime
A+ Mouse *(optical mouse)* . . . . . 65.
A+ Mouse ADB *(for Mac SE & II)* . . . . . 85.

Nutmeg Systems ... 90 days
Nutmeg 19" Monitor *(for MacPlus or SE)* 1495.
Nutmeg 19" Monitor *(for Mac II)*. . . . . 1595.

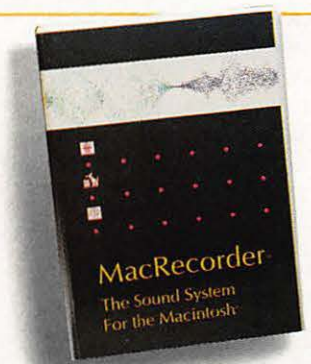
Nuvotech
TurboNet/AppleTalk connector cable . . . . . 6.
TurboNet *(DIN8 or DB9 connector)* . . . . . 27.

Orange Micro ... 1 year
Grappler *(universal parallel interface)*. . . . . 79.

Passport Designs ... 90 days
Passport MIDI Interface . . . . . 95.
MIDI Transport *(2 MIDI in, 5 MIDI out)* . . . 339.

Personal Computer Peripherals ... 2 years
HD-WSI *(connects Apple HD 20 to SCSI)* 269.
MacBottom HD 21 Meg SCSI. . . . . 749.
MacBottom HD 21 Meg SCSI w/Modem 915.
MacBottom HD 32 Meg SCSI . . . . . 899.
MacBottom HD 32 Meg SCSI w/Modem 1045.
MacBottom HD 45 Meg SCSI. . . . . 1149.
MacBottom HD 45 Meg SCSI w/Modem 1295.
MacBottom HD 70 Meg SCSI . . . . . 1395.
MacBottom IHD-144 Meg *(for Mac II; 1 yr.)* 2189.

Practical Peripherals ... 5 years
1200 Baud External Modem . . . . . 109.
2400 Baud External Modem . . . . . 189.



Farallon Computing ... NCP
MacRecorder™—Personalize your Mac with your own beep sound, or add sounds to HyperCard Stacks. MacRecorder makes it simple. Includes sound edit for creating special effects . . . $145.

SoftStyle ... 90 days
MacEnhancer *(for plotters to printers)*. . . $159.

Summagraphics ... 90 days
MacTablet 12" x 12". . . . . 379.

Thunderware ... 90 days
ThunderScan 4.0 with PowerPort. . . . . 199.
Mac II Power Accessory. . . . . 42.

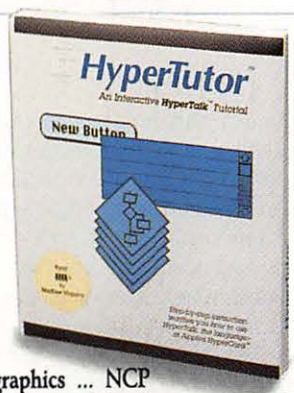
DISKS

Double-sided diskettes.

Sony 3½" DS/DD Disks *(box of 10)* . . . . . 18.
Fuji 3½" DS/DD Disks *(box of 10)* . . . . . 19.
Verbatim 3½" DS/DD Disks *(box of 10)* . . . 19.
MAXELL 3½" DS/DD Disks *(box of 10)* . . . 20.

INFORMATION SERVICES

CompuServe
CompuServe Information Service . . . . . 24.
Grolier's Online Encyclopedia . . . . . 32.
CompuServe Navigator. . . . . 45.



Telegraphics ... NCP
HyperTutor—Get help when you need it. HyperTutor works within HyperCard to give you immediate on-screen help and instruction for your HyperCard Stacks . . . . . $30.

Dow Jones
Dow Jones News/Retrieval Membership Kit 24.

ACCESSORIES

Bantam Books
The Complete HyperCard Handbook . . . . 24.

Clean Image Ribbon Co.
Clean Image Ribbon Kit. . . . . 12.

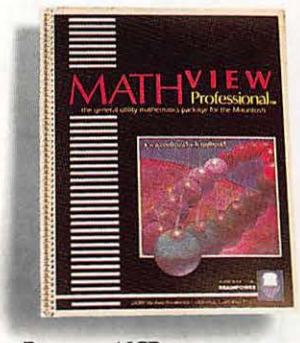
Computer Coverup
External 800k Drive Cover . . . . . 4.
ImageWriter II Cover . . . . . 8.
Mac Plus or Mac SE Cover Set. . . . . 10.

Goldstein & Blair
The Macintosh Bible *(incl. 2 free updates)* 16.

I/O Design
Imageware II *(ImageWriter II carry case)*. . . 49.
Macinware SE *(Mac SE carry case)* . . . . . 79.

Kalmar Designs
Teakwood Roll-top Case *(holds 45 disks)* . . 14.
Teakwood Roll-top Case *(holds 90 disks)* . . 20.
Teakwood Roll-top Case *(holds 135 disks)* 27.

Moustrak
Available in a variety of colors.
Moustrak Pad *(standard 7" x 9")*. . . . . 8.



BrainPower ... NCP
MathView Professional—Superb mathematical and computation program. Handles linear and non-linear equations, 2 and 3 dimensional plotting, stats and series operations, etc. . . . . $145.

Moustrak Pad *(large 9" x 11")* . . . . . 9.
Moustrak Pad L/F *(9" x 11")*. . . . . 10.
Moustrak Pad L/F *(Designer Series)*. . . . . 12.

Ribbons
ImageWriter Ribbons. . . . . 4.
Available colors: black, blue, brown, green, orange, purple, red, yellow, silver and gold.
Rainbow Pack *(6 single color ribbons)* . . . . 20.
Multi 4-Color Ribbon *(req. ImageWriter II)*. . . 9.

Sensible Softworks
Quality "MacAttire" nylon dust covers. . . 7-17.
High Trek ImageWriter II carry case . . . . . 49.
High Trek Mac SE & ext. kybd. carry case 69.

Targus (Canada) Ltd.
ImageWriter II Carry Case *(black)* . . . . . 49.
MacPlus Carry Case *(black)* . . . . . 59.

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- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order.
- No sales tax.
- All U.S. shipments insured; no additional charge.
- APO/FPO orders shipped 1st Class Mail, charged by weight.
- Allow 1 week for personal and company checks to clear.
- COD max. $1000. Cash or certified check.
- 120 day limited warranty on all products.*
- To order, call us anytime Monday thru Friday 9:00 to 9:00 EST, or Saturday 9:00 to 5:30 EST. You can call our business offices at 603/446-7711 Monday through Friday 9:00 to 5:30 EST.

SHIPPING

Continental US: Barring massive computer failures and other natural or unnatural catastrophes, all non-C.O.D. orders phoned into MacConnection by 8 PM EST will ship Airborne the same night for next day delivery, except for those within UPS Ground Zone 1 (which is also an overnight service). The total freight charge on any order placed with MacConnection is now $3. Backorders will also ship Airborne overnight at no additional charge. Some areas require an additional day delivery.

Hawaii, Alaska and Outside Continental US: Call 603/446-7711 for information.

Macintosh Masterpieces

by Joe Matazzoni

Presenting the winners of the first Macintosh Masters art contest

When we mentioned in the announcement of *Macworld*'s first annual art contest that slides of Mac-designed sculpture and mixed-media pieces would be acceptable, we were just shooting in the dark. We had no idea whether anyone was actually doing such things, we just hoped they were and wanted to let people know we were open to anything.

Well, people seem to have gotten the message.

The hundreds of Mac Masters submissions that poured in from around the world showed that both the Macintosh and Mac users are living up to their reputations: the former as a powerful graphics machine, the latter as a creative band of boundary pushers. Not only did we receive mixed-media and sculptural submissions (witness the winning entry on the facing page), we got a number of works that defied even the broad categories we set up for the contest. How, for example, do you judge a giant soft sculpture with a Macintosh *inside* it? Is that computer art? Or which category does a Mac-machined aluminum time capsule belong in? For a while, every morning at *Macworld* was like Christmas, as each day's mail revealed a new haul of everything from fabric wall-hangings incorporating Mac graphics to clothes made from Mac-patterned material, handmade books, star charts, and musical scores. Finding new output methods for their graphics was one area where Mac artists displayed particular ingenuity; our collection included etchings, silk screens, digital photographs, lithographs, and other pieces made with completely new, hybrid techniques.

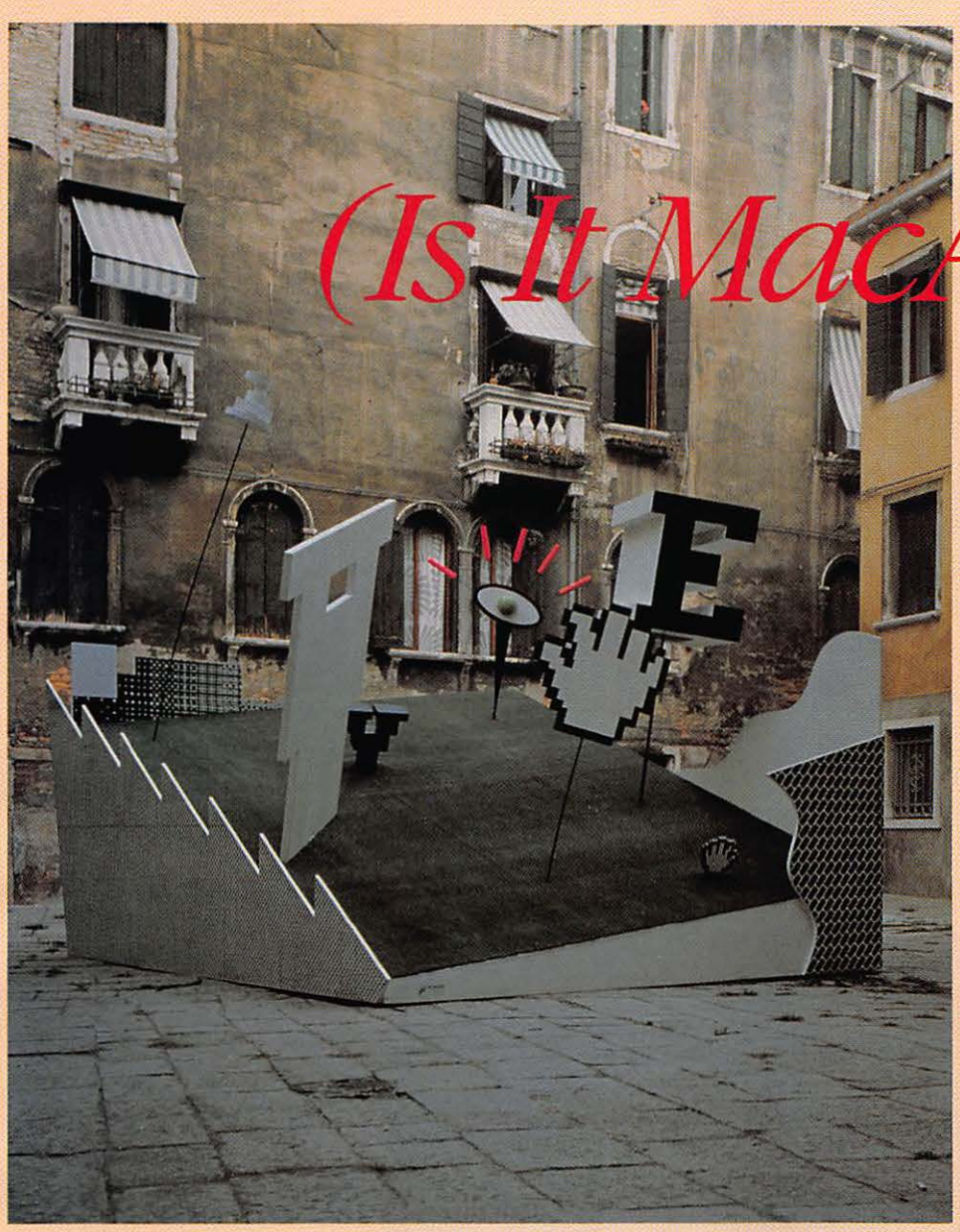
Evaluating this heterogeneous collection required a panel with experience in both the art world and the world of computers. Loren Carpenter, senior scientist at Pixar and a recognized authority on image processing and computer animation, was indispensable when it came to judging the more technically sophisticated submissions. Jack Davis, image editor for the Mac art journal *Verbum,* lent his knowledge of Macintosh graphics to the effort. On the purely artistic side, expert judgment was supplied by Sidra Stich, senior curator at the University Art Museum in Berkeley, California, and by Robert Johnson, curator of the Achenbach Foundation for Graphic Arts at the California Palace of the Legion of Honor, in San Francisco.

The judges selected winners in six of the eight contest categories. The winners will choose a software prize from a selection of graphics products donated by the contest's sponsors (see below). Two of the category winners also earned top honors. The grand-prize winner will receive a Mac II donated by Apple; a cash award of $2000 goes to the runner-up. We'll announce these two winners at the SIGGRAPH computer graphics conference this month in Atlanta; check *Macworld News* next month for the story.

So is it art? Certainly—some of it. Which pieces qualify will probably be different for each beholder. What everyone should be able to agree on, however, is that the winning entries are head and shoulders above anything you could have seen on the Mac a year ago. No doubt we can expect to see the same exponential increases in sophistication from year to year through at least the next few contests—something to look forward to. Meanwhile, on behalf of *Macworld* I'd like to congratulate this year's winners, thank the sponsors and all the artists who participated, and invite everyone to help make next year's contest an even greater success. □

This year's Macintosh Masters contest was made possible by support from the following companies: Adobe Systems, Aldus Corporation, Apple Computer, Cricket Software, Letraset USA, Microsoft Corporation, Silicon Beach Software, and SuperMac.

(Is It MacArt Yet?)



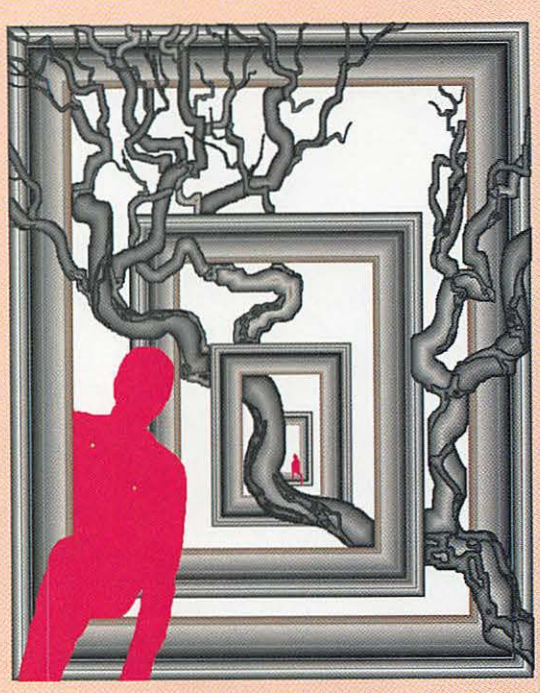
(A)

FINE ARTS

First Prize (A) ***Pacific Wave Sculpture*** **When the Fortuny Museum in Venice, Italy, asked Los Angeles designer April Greiman to produce a sculpture for the museum's Pacific Wave Festival, a celebration of California graphic designers, Greiman turned to her Macintosh. Since she knew no Italian and the Venetian fabricator knew no English, all communication had to be visual. Greiman drew up the plans in MacDraw and FullPaint, digitized a scale model using MacVision, and then faxed the drawings and digitization to Italy. "When I arrived," she remembers, "there it was, waving at me, just as I'd imagined."**



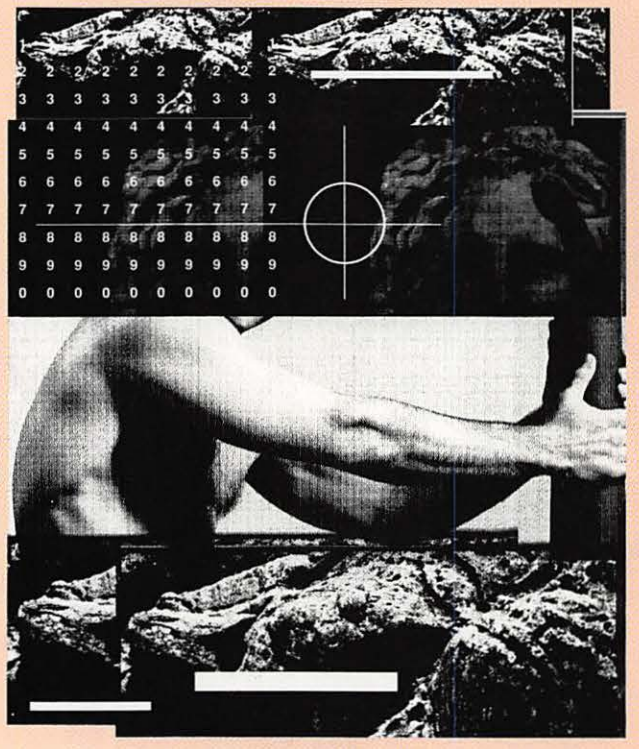
(B)



(D)

FINE ARTS

Honorable Mention (B) ***Boxicopia*** **To create this 3-by-4-foot hanging, Susan Migliore of Laguna Beach, California, used a color-xerox, heat-transfer process to put MacPaint images onto painted and dyed linen. To add dimension, she sewed the fabric onto bent-wire armatures. (C)** ***Mediterranean Discourse*** **Michael Tidmus of Los Angeles created this collage from 4-bit grayscale scans that he manipulated in ImageStudio, saved as TIFF files, and then assembled in PageMaker. (D)** ***Exposition*** **Dominique de Bardonnèche-Berglund from Morges, Switzerland, created the frames in this PixelPaint image using the Shape Burst tool. (Not Shown)** ***Chair Facing Blue Ocean Waves*** **Chiu-ping KU, Hong-Kong.**



(C)



(D)



(A)



(C)



(B)

ILLUSTRATION

First Prize (A) ***Street*** **Except for the Chieftain Safari Wagon, which he drew in Illustrator, Brooklyn's Bert Monroy created the image entirely in PixelPaint. The use of gradations throughout lends the image its richness.**

Honorable Mention (B) ***Oni-men*** **David Hastings of Seattle fashioned this mask in Aldus FreeHand. He based the design on the Kumadori style of makeup used in Kabuki theater. (C)** ***Afternoon on Titan*** **Ron Cobb of Santa Monica, California, painted this hypothetical landscape of Saturn's sixth moon primarily in PixelPaint's FatBits mode, for better control. The monochromatic palette centering on orange depicts Titan's perhaps romantic-looking but certainly lethal methane atmosphere. (D) Lance Jackson of Oakland, California, developed his distinctive style of Mac caricature working for the** ***San Francisco Examiner.*** **He drew this cartoon of Robin Williams in SuperPaint. (Not Shown)** ***Rudolph*** **Scott Baldwin, Los Angeles.**



(A)

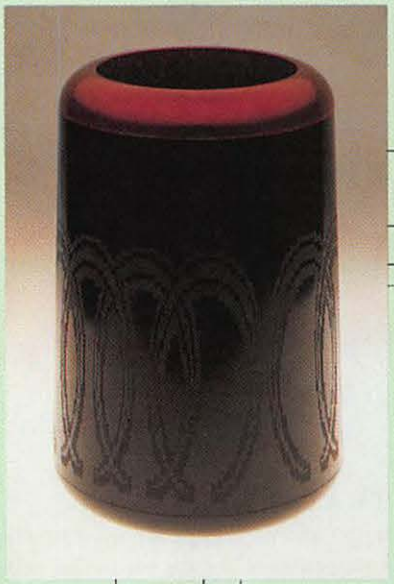




GRAPHIC DESIGN/PUBLISHING

First Prize (A) ***L'art offensif*** **Alain Côté (creative director) and Yve Bernard (art director, designer, and illustrator) pulled out all the stops on this brochure for their Montreal design studio, Concept-Exclusif. On each page, Mac-typeset line art and type are layered in a complex collage with photography, pencil drawing, airbrush, stamped images, and spot varnishes. Placement and shape of the non-Mac elements were determined on the computer, as these laser-printed thumbnails show.**

Honorable Mention (B) ***The Vessel Project*** **Lyons, Colorado, engineer Dick Hodges describes his solid-aluminum vases/time capsules as "art objects combining sculpture, precision machine work, and Macintosh graphics... artifacts of the early computer age." Designed in MacDraft and decorated with SuperPaint patterns, the vessels are machined according to instructions from control programs coded on the Mac. The prototype vessel didn't fit into any of our categories, but the superior design of the documentation won a mention here. (C)** ***Emanuel's Manual of the Simple Life*** **(Missing Books, London, 1987) Michael Green, who lives in Jerusalem, notes accurately that his laser-printed PageMaker meditation "doesn't belong in any recognizable literary category." The book does, however, deliver on the promise desktop publishing has always held out of making possible more experimental, personal works. (D)** ***Two Lyric Pieces*** **(Equinox Music, Manchester, Vermont, 1987) Bruce Hobson of Manchester Center, Vermont, used SuperGlue to transport the Deluxe Music Construction Set file of this original piano solo into Illustrator. There he added his own slurs and customized the stock symbols of Adobe's Sonata music font. Other programs Hobson used include Fontographer, SuperPaint, Canvas, and PageMaker. (E)** ***The Raven*** **Tom Ahern of Warwick, Rhode Island, assembled scanned imagery with text in PageMaker to create this cover for a handmade book.**



(B)

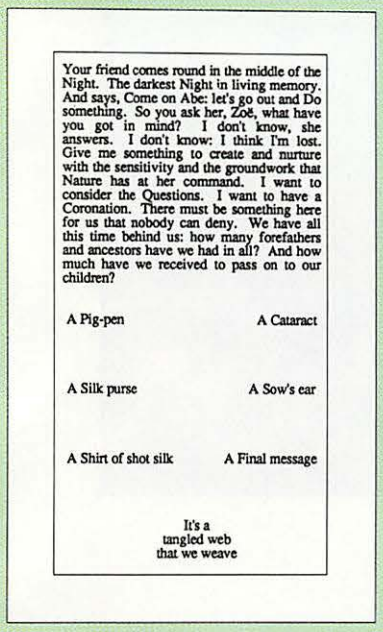
ANIMATION

First Prize(A) ***Burnout*** **David Herrold of Greencastle, Indiana, based much of the action of this black-and-white animation on video sequences. Herrold used a Magic video digitizer to bring video segments frame-by-frame from the TV screen into the Mac, where he embellished them using 3-D and paint software. He then reassembled his work on movie film by shooting the 5½-minute piece's 5000 frames one at a time from the Mac screen.**

Honorable Mention (B) ***Crew Emergency Return Vehicle Presentation*** **Chipp Walters and a team at Design Edge in Houston prepared this piece to show NASA the space station's escape vehicle in transport, storage, and deployment. The 3-D models were created in Super 3D.**



(A)



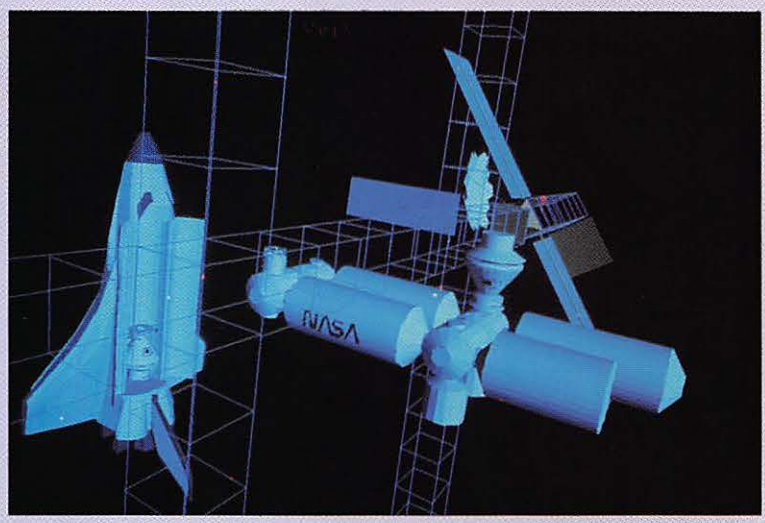
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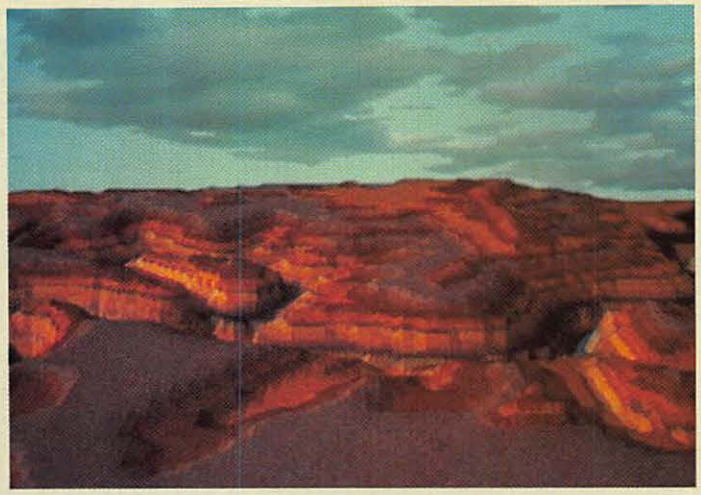
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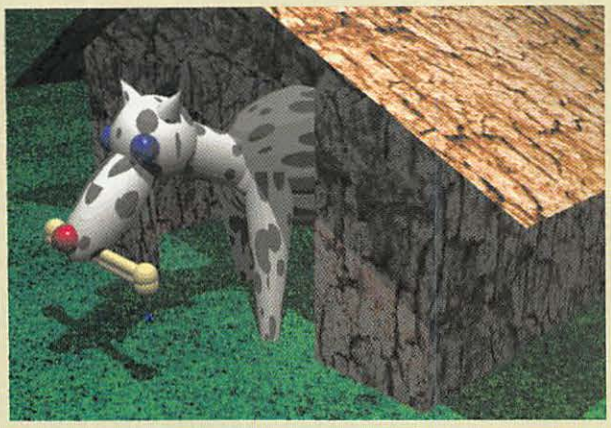
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3-D/IMAGE SYNTHESIS

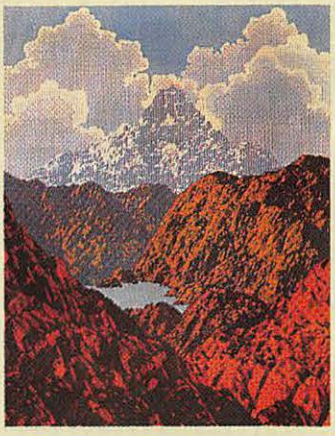
First Prize (A) ***Southwest Meander Looking South*** **Dan Spence of Fort Mitchell, Kentucky, uses three computers and his own imaging software to produce landscapes. On a graphics tablet he sketches an overhead view of a landscape, marking out any distinctive high and low points. An Apple III reads that drawing off an Inovion screen and translates it into elevation data. That data is then mixed with color information that keys elevations to specific shades, and a Mac II renders the final picture. Honorable Mention (B)** ***Biff*** **Brian E. Pinz rendered this playful image using a ray-trace program developed at the University of California at Santa Barbara. A digitized pattern was applied to Biff's doghouse to create the bark texture. (C)** ***Random Peak*** **Printmaker David C. Dickinson of Mount Morris, New York, used MacFractal to create the basic forms of this landscape. He then took the image into SuperPaint, where he edited it and manually produced four separations. A Canon color copier was used to combine the separations on rag paper. (Not shown)** ***Ralph/chair 22*** **Young Harvill, Palo Alto, California, and Sean McKenna, San Francisco.**



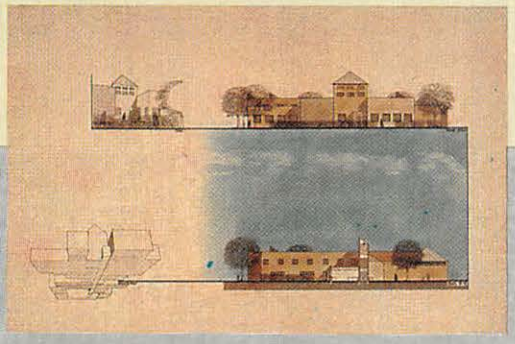
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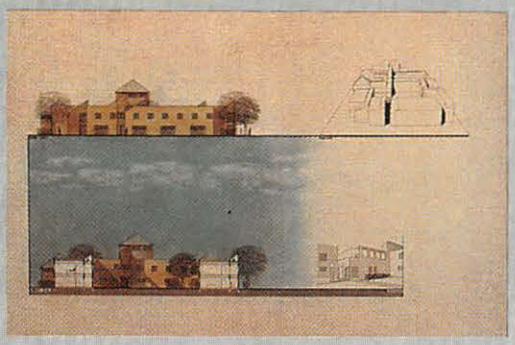


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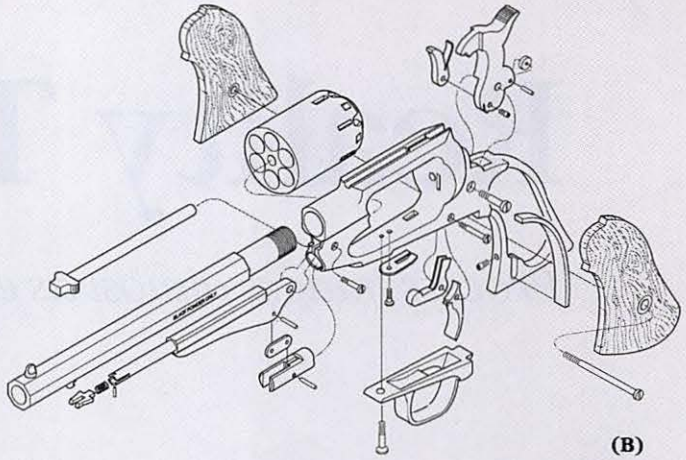
ARCHITECTURE

Honorable Mention ***Proposal for Transitional Shelter for Albuquerque's Homeless*** **Christopher Purvis of Santa Fe, New Mexico, completed the initial design work for this proposal in MacDraft. He drew the trees and other details in SuperPaint and made the 3-D views in MacModel. Purvis assembled the images in MacDraft, plotted the final picture, and added LaserWriter titles printed on sticky-back. After having that composite sepia-tone printed, he added color using chalk pastels. (Not Shown)** ***Silvetti*** **Darrell Fields, Arlington, Texas.**

TECHNICAL ILLUSTRATION

First Prize (A) ***High Performance*** **Michael Scaramozzino of Providence, Rhode Island, used Illustrator and a drawing tablet to create this smoothly realistic Lamborghini Countach.**

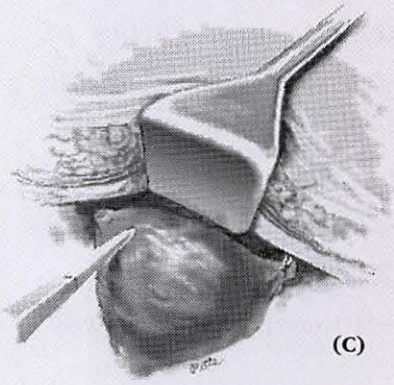
Honorable Mention (B) ***1859 Remington Army .44 Caliber*** **Jim Mullen of Battle Creek, Michigan, drew the exploded view of this Civil War pistol to scale in Illustrator. He later created a shaded rendering (not shown) by assembling the visible parts of the gun on screen. (C)** ***Abdominal Hysterectomy*** **Bobby Pitts of Rochester, New York, began this illustration in ImageStudio, painting freehand with the program's gray-scale editing tools. He saved the ImageStudio file in TIFF, then brought it into LaserPaint to add vector lines and text. (Not Shown)** ***Canon EOS 650*** **Gunter Dunz-Wolff, Hamburg, West Germany.**



(B)



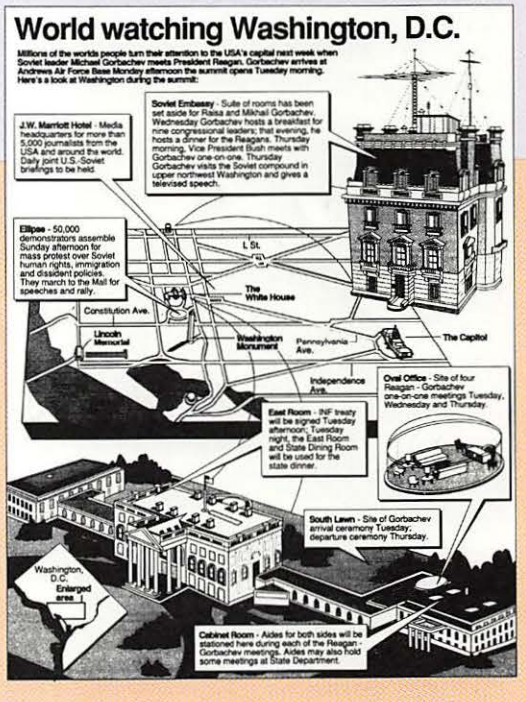
(A)



(C)

INFORMATIONAL GRAPHICS

Honorable Mention ***World Watching Washington, D.C. USA Today*** **has been a leader in the use of Macintosh news illustrations. Here Bill Baker, of Washington, D.C., has used MacDraw to help a curious nation visualize Reagan and Gorbachev's schedule during the event-filled days of their third summit meeting. (Not Shown)** ***The Soft Benefits of Scanning*** **Roger Sawhill, Atlanta.**



Reality Transformed

Process images almost as easily as revising text

"All the pictures which science now draws of nature and which alone seem capable of according with observational fact are mathematical pictures. . . ."

—Sir James Hopwood Jeans, 1930

by Brita Meng

In the simplest sense, image processing means manipulating a picture—modifying, enhancing, or analyzing it. Adjusting the brightness on a television set is one type of image processing; by changing analog voltages, you alter the brightness of the picture displayed on the screen.

The Macintosh, however, manipulates digital information. To process Mac images, applications like ImageStudio or Digital Darkroom use mathematical formulas to manipulate the individual picture elements or *pixels* that make up each image.

Image processing differs from computer graphics. Whereas applications such as paint programs allow you to create computer-generated images from scratch, image processing lets you analyze and alter images from real-world sources such as video recorders, satellite cameras, and CAT scanners.

The Rudiments of Image Processing

To enter an image into the Mac, the image must be digitized by an input device, for example a scanner or a video camera. Scanners and digitizers break down a continuous-tone image, such as a photograph, into an array of pixels. With the appropriate scanner, each pixel can include gray-level or color information.

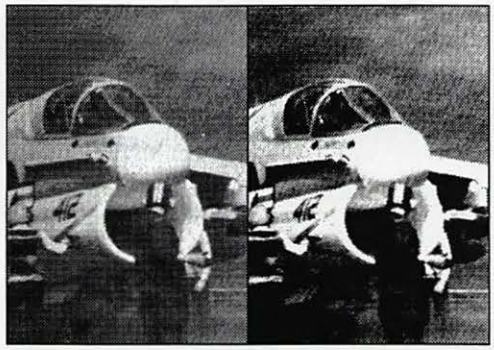
Digitizers take input from a video source like a camera. Pixelogic's ProViz, Mass Micro's ColorSpace, and Comtrex's Imagizer are all examples of digitizers. Frame grabbers capture a single video frame from a camera or a video cassette recorder (VCR) in 1/30 second; video equipment displays data at 30 frames per second. Data Translation's QuickCapture and ColorCapture and TrueVision's NuVista board are examples of frame grabbers. Grabbed images can be stored, displayed, and processed on the Mac. Before being processed, the entire digitized image must be loaded into the Mac's RAM or, if the Mac uses external hardware, into the memory of a dedicated image processor.

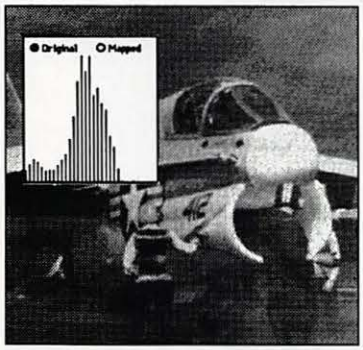
To display an image accurately while you work with it, you need a monitor that displays gray levels or color, particularly if you're working with a continuous-tone image. Some operations manipulate pixels so

JEFFERY NEWBURY



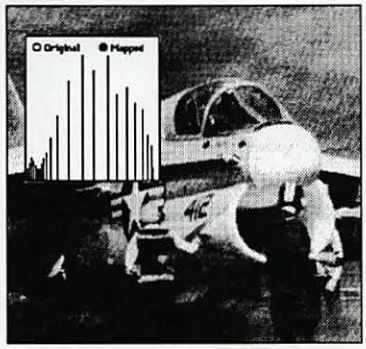
Brightness and Contrast
The original Thunderscan image imported into Digital Darkroom (left) is a little light, and there's also not enough contrast. You can adjust the brightness and contrast controls to enhance the image.





Histogram
A histogram *map shows the* distribution *of gray levels in an image. For example, this histogram shows that most of the pixels in the image are medium gray, and that the whole image contains very few dark grays.*

Equalized Histogram
By equalizing *its histogram, you can expand an image's dynamic range so that it contains more dark gray areas. This enhances the image.*



Pseudocolor
When you pseudocolor *an image, you assign specific colors to gray values. Here, a gray-scale image on NuVision has been pseudocolored for red, green, and blue.*



Posterization
Posterizing *restricts the number of gray shades that can appear in an image. This image was posterized at three gray levels to see false contouring and better discrete colors. The original image contained 256 gray levels.*



subtly that some black-and-white displays—like the built-in Mac Plus or SE monitors—don't really show the results.

Saving a captured image requires a high-capacity mass storage device like a large hard disk or an optical WORM (write-once, read-many) drive. An 8½-by-11-inch image with 256 gray levels, scanned at 300 dots per inch, could take up 8.4 megabytes on a hard disk.

Finally, you can print an image with a variety of output devices: a laser printer, a phototypesetter, a film recorder, even a dot-matrix printer like the ImageWriter. Which device you choose depends on the resolution and quality you're after. If high-quality output is particularly important, you may need to output to a film recorder or phototypesetter.

Two Approaches to Image Processing

Image processing is a very computation-intensive job. In fact, it was only recently that personal computers acquired the processing power necessary to perform the operations in seconds rather than minutes, or maybe even hours.

ImageStudio, Digital Darkroom, and MacImage are all examples of software-based image processing. They use the Mac's internal microprocessor, either the 68000 or 68020 chip, to process pixels.

Because the Mac's CPU limits how fast an image can be processed, complicated imaging functions benefit greatly from additional image processing hardware like Perceptics' NuVision.

Hardware-based image processors come in two forms—general purpose and dedicated. NuVision is an example of a general-purpose system (see "NuVision Hardware for Image Processing"). Apple and Pixar are also working on a product that will allow a Mac II running A/UX to control the Pixar Image Computer (PIC). The PIC is a powerful general-purpose image processor capable of three-dimensional or *volume* imaging. This process creates three-dimensional images from a series of two-dimensional pictures taken from different perspectives (see "3-D Imaging").

Image Gallery

There are a variety of ways to modify an image—changing the brightness and contrast, enhancing the edges of objects, even removing unwanted visual defects. ImageStudio, Digital Darkroom, MacImage, and NuVision use preprogrammed *algorithms,* or mathematical formulas, to process images. Knowing what some common algorithms do can help you decide which operations to perform and which application you need (see "What You Can Do with an Image").

A point-process algorithm operates on every pixel in the image area and uses each pixel's value to compute a new value for the pixel. If you're working with an image that is too dark and lacks contrast, you can lighten it and increase the contrast by applying a simple point process (see "Brightness and Contrast").

You can also change an image's dynamic range by using a point process called *histogram equalization,*

NuVision Hardware for Image Processing

Perceptics' NuVision is the first hardware image processor based on the Macintosh II. Instead of the Mac II's 68020 processor, NuVision uses specially designed image processing hardware to divert processing from the Mac's CPU.

The Mac II acts as the host computer and controls all of NuVision's image processing operations. The NuVision chassis connects to the Mac II and houses up to six add-in boards. NuVision allows these boards to work in parallel, processing images simultaneously.

In its basic configuration, NuVision comes with three boards: the Smart Memory board and the Video Interface board, both of which plug into the NuVision chassis, and a Mac II NuBus interface board, which plugs into the Mac II. The Video Interface board lets NuVision display images at up to 1280 by 1024 pixels and contains a frame grabber.

The Smart Memory board contains a digital signal processor (DSP) dedicated to image processing. Whereas the 68020 is a general-purpose processor, the DSP, a 40-megahertz Texas Instruments 32025, is specifically designed to process bits, or pixels. An optional board, the Pixel Processor, is designed for logic functions, such as the addition and subtraction of images.

Because NuVision operates on images stored in the Smart Memory board and each board contains its own dedicated processor, imaging operations run many times faster than on the Mac. For example, you can use a NuVision system equipped with three Smart Memory boards to process a color image; assigning one Smart Memory board to each color plane (red, green, and blue) reduces the overall processing time for the image.

an algorithm that changes the distribution of gray levels (see "Histogram" and "Equalized Histogram").

You can color an image by assigning specific colors to gray values in an image. This operation, called *pseudocoloring,* is another point process (see "Pseudocolor").

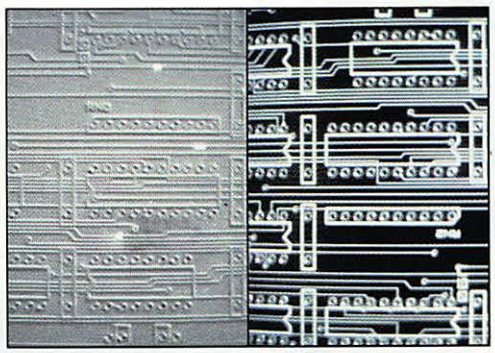
If an image looks too smooth because its gray shades blend together, you can make it bolder by using a point process called *posterization* (see "Posterization").

Often you can combine images to produce a desired effect. For example, you could compare one image with another to check for defective parts coming off an assembly line (see "Subtraction"). Operations involving more than one image are called *frame processes.* You can use frame processes to improve image quality and to detect motion.

To correct the distortion caused by camera optics or viewpoints, you can apply what's called a *geometric process,* an algorithm that changes the spatial arrangement of pixels to a specified shape. You can also use a geometric process to create special warping effects (see "Warping").

You can alter an image's appearance, or locate specific information, with an *area* or *spatial* process. For example, you can sharpen an image using a filter (see "Sharpening"). Spatial processes change a pixel's original value using a formula based on that value and the values of neighboring pixels.

If you want to locate specific information—perhaps all the edges in an image—you can perform a classic spatial process called *convolution* (see "Fil-



Subtraction

A frame process *can highlight the differences between two very similar images. The reference image shows a nondefective printed circuit board. Using NuVision to* subtract *a camera image of the same portion of a "bad" printed circuit board highlights the differences as very light blotches.*

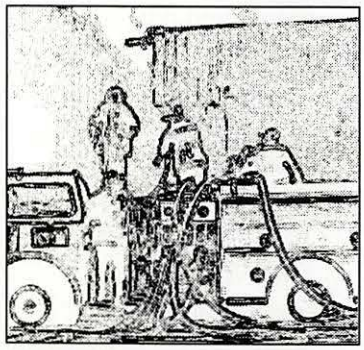


Warping

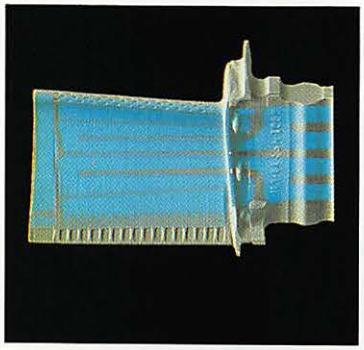
Warping *corrects for camera optics and also creates special effects. The balloons in this 24-bit color image have been magnified, rotated, and warped into a parallelogram using Perceptics' NuVision.*



Sharpening
ImageStudio's Sharpen More filter can sharpen an image repeatedly. The image of a fire truck was sharpened twice.



Filtering
Filtering *lets you find all the edges in an image. This image shows what happens when you locate edges of the fire truck. Digital Darkroom lets you choose the width of the line defining the edge; in this case, it's a thick line.*



3-D Imaging
Internal air passages used for cooling a turbine blade appear in blue in this volumetric *reconstruction from computer tomography slices.*

tering"). Convolution lets you *filter* an image for the features you want.

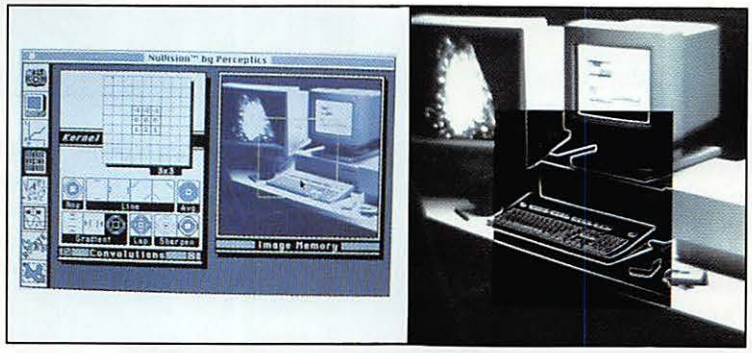
The convolution operation replaces a pixel's value with the sum of the values of that pixel and its neighbors, each weighted (multiplied) by a certain factor. The weighting factors are called the *convolution kernel* or filter. By using different weight factors in the filter, you can manipulate an image in many ways such as smoothing it (see "Convolution") or even isolating all its vertical or horizontal lines.

With some images, convolution will not achieve the desired result. Say, for example, that you have an image of a black object on a dark background. Because there's not enough contrast between the object and the background, you can't tell them apart.

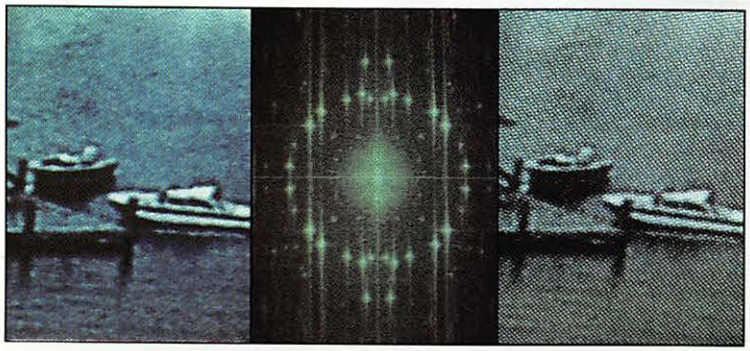
Like your eyes, convolution filters work better at discerning obvious contrasts, or *spatial frequency* changes, within an image. If an object and a background are too similar, a filter must process more pixels to tell them apart—the less difference in contrast, the larger the area the filter must process. The convolution process can, of course, reach the point of diminishing returns as far as processing time is concerned —especially if you're working with a very large image.

Let's say you have an image with low overall contrasts, as is the case with X-rays or CAT scans. If you have a dark object on a black background, you can isolate the object using an algorithm called a *Fourier transform.*

The Fourier transform identifies the actual color frequencies that occur in an image. By isolating an image's color frequencies, you can perform point processes on selected frequencies. For example, to highlight an object in an X-ray, you can multiply the object's frequency by a large number. Similarly, you can multi-



Convolution
This image from NuVision shows one 3-by-3 convolution kernel, *or filter, enhancing edges. In the photo on the right, a Sobel filter is being applied to one region of the entire image.*



(a) (b) (c)

Fourier Transform
The 8-bit monochrome image in (a) shows a considerable amount of periodic noise, *random aberrations in pixel values. By performing a Fourier transform, you can see the frequencies of the image data. Photo (b) shows the result of that transform. The periodic noise produces a set of frequency peaks in a circle around the center of the spectrum. You can suppress those frequency peaks by performing point processes or by filtering the peaks. After performing an* inverse Fourier transform, *the periodic noise disappears (c).*

What You Can Do with an Image

	Digital Darkroom[1]	ImageStudio	MacImage	NuVision
Brightness/contrast control	x	x	x	x
Custom map	x	x	x[2]	x
Blur	x	x		
Despeckle	x			
Diffuse	x[3]	x		
Enhance edges	x	x		x
Sharpen	x	x		x
Custom filters	x			x
Custom programs	x[3]			x
Posterize	x	x	x	x
Equalize histograms	x	x		x
Invert	x	x	x	x[4]
Rotate	x	x[5]		x
Warp	x			x
Fourier transform				x
Object measurement (blob analysis)				x
Halftone print	x[6]	x	x	
Other features	Autotrace converts bitmapped graphics to object-oriented graphics; advanced graphics selection tools	Custom Paint tools included	Works only with images from Datacopy scanners; some bitmap-editing features	Parallel processing capability; 24-bit color support; requires Mac II
Exportable file formats	PICT II, TIFF, Digital Darkroom Archive, ThunderScan	RIFF, MacPaint, TIFF, encapsulated PostScript	PICT II, TIFF, MacPaint, RIFF, Datacopy IMG, LaserBits, PageMaker 1.2, encapsulated PostScript	TIFF

[1]Compiled from beta version.
[2]Extensive mapping capabilities with gamma functions, including edge detection and noise control.
[3]Add-on module.
[4]No menu choice; done with custom map.
[5]Rotation possible only in 90-degree increments.
[6]PostScript and non-PostScript printers.

ply a specific frequency by zero to eliminate that frequency from an image (see "Fourier Transform").

To display an image with its modified frequency information, you apply an algorithm called an *inverse Fourier transform.*

Everything in the Picture

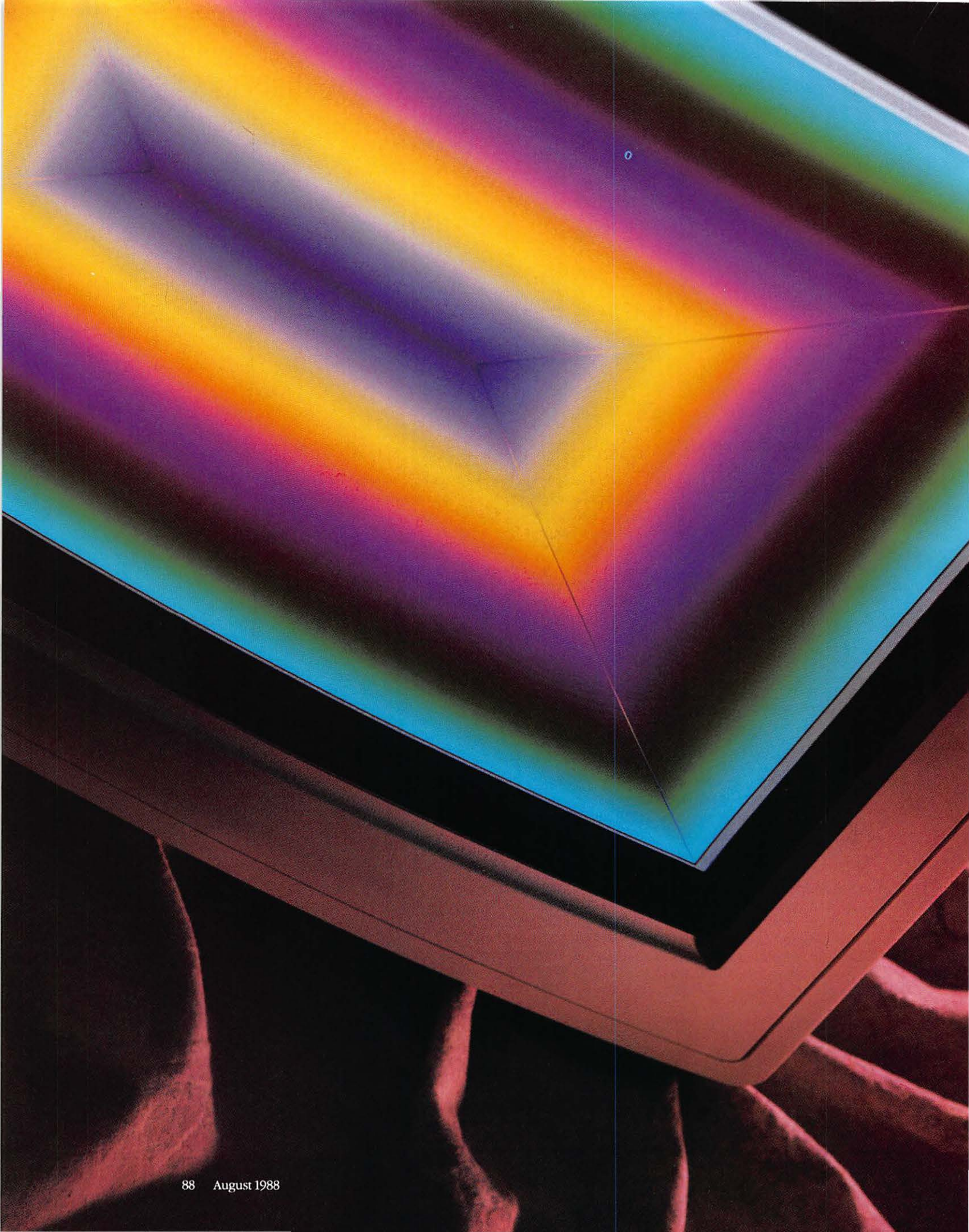
The advent of Mac-based image processing systems has brought everyone into the picture. The cost of admission is merely a Mac, a digitizer, and the required software. Even shareware image processing programs are appearing for the Mac II. And you don't have to know how to program algorithms—just pull down a menu.

Once you start processing images, though, you'll want to do more. In moving up to the high end, you'll need a Mac II, more memory, a high-resolution scanner or digitizer that reads color or gray-scale information, and a monitor that displays that information. In some cases, you'll even need dedicated image processing hardware.

To take full advantage of the Mac's image processing capabilities, it helps to understand the underlying principles. When you do, you're in a better position to evaluate the products now available for the Mac. Then you'll know just what to do when you're faced with an image. □

The author would like to thank Andrew Wilson for his assistance with this article.

See *Where to Buy* for contact information.



Select a color screen for the Mac II. Compare 12 of the best.

Color Monitors Revisited

by Bruce F. Webster

As I complete this review, I'm surrounded by more color monitors than I ever expect to see in one place again. Twelve, to be exact. If I plugged them in and turned them on all at the same time, I'd probably get a suntan or something. As it stands, I'm probably going to have to see my chiropractor; most of these monitors are 19-inch RGB models, and they are heavy.

To business. Since I reviewed color monitors for the Mac II last December ("Looking through the Mac II Kaleidoscope"), a number of new or improved ones have come on the market. Likewise, some of the existing video cards

PHOTOGRAPHS BY DAN ESCOBAR

Comparing Color Monitors

Monitor Model	Price	Size	Display Area	Maximum Resolution	Resolution Used	Dots per Inch
AppleColor High-Resolution RGB Monitor	$999	13″	235mm × 176mm	640 × 480	640 × 480	70
Conrac Model 7250	$2995	19″	360mm × 270mm	1024 × 1024	640 × 480	45
Conrac Model 7351	$2995	19″	396mm × 297mm	1024 × 1024	1024 × 768	69
Electrohome ECM 1910	$2895	19″	350mm × 260mm	n/s	640 × 480	46
Electrohome ECM 1912	$2995	19″	350mm × 260mm	n/s	640 × 480	46
Nanao Flexscan 8060S-US	$919	14″	250mm × 167mm	930 × 625	640 × 480	80
Princeton's Ultrasync	$849	12″	215mm × 160mm	800 × 600	640 × 480	73
Sony GDM-1602	$2495[1]	16″	295mm × 221mm	1024 × 768	1024 × 768	84
Sony GDM-1952	$3695[2]	19″	360mm × 270mm	1024 × 768	1024 × 768	72
Taxan MultiVision 770 Plus	$915	13″	252mm × 185mm	n/s	640 × 480	69

n/s = not specified
[1]RasterOps price $4395 with Spectrum/8 or PCPC card.
[2]RasterOps price $5795 with Spectrum/8, $5295 with PCPC card.

have been upgraded, and new ones have appeared. Most exciting is the release—well, it's still in beta as I write this, but it's beta 0.95—of a 24-bits-per-pixel color video card for the Mac II.

AppleColor Replacements

Several of the monitors I received are intended to replace the AppleColor High-Resolution RGB Monitor. They include the Nanao Flexscan 806OS, Princeton Graphics Systems' Ultrasync, and the Taxan MultiVision 770 Plus.

With a sense of déjà vu, I must announce that the AppleColor is the best of the small RGB monitors I looked at. It has the crispest display, the most vivid color, and no distortions. The only apparent flaw (for those bothered by such things) is the almost invisible hairline across the screen two-thirds of the way down, caused by a wire that supports the Trinitron mask. Some folks are bothered by the line and by the rather startling noise the machine makes when you power it up; I've long since ceased to notice either.

Second place goes to the Nanao Flexscan. I wasn't too impressed with its display at first, but with some fine adjustments I was able to center the image and display true circles and squares with equal height and width, an indicator of the monitor's 1:1 pixel aspect ratio (the ratio of pixel height to width). Also, by measuring on-screen images with a flexible plastic ruler, I determined that the Nanao monitor displays objects at their actual size—that is, an on-screen ruler's measurements are accurate according to a real-life ruler.

The Nanao's colors are nice, though a bit paler than the AppleColor's. Text is crisp and firm. There is some bowing of the image, bending in on the left and out on the right, but nothing critical. The monitor itself comes with plenty of controls and adjustment points. In the front it has knobs for horizontal size, vertical size, display color, contrast, brightness, and power. In the back are knobs for vertical position and horizontal position. The monitor comes mounted on a tilt/swivel base, and one of the knobs in front lets you switch between amber, monochrome, and color displays. As with all the replacement monitors, you can switch between analog RGB (the standard for Mac II color video cards) and TTL-level inputs, allowing you to use the display with a number of IBM-compatible video cards.

Princeton's Ultrasync is right up there, too, though I'd probably choose the Nanao over it. The Ultrasync has no visual distortions; however, the Mac desktop background behind an open window appears slightly darker than on the AppleColor. The image isn't as sharp as on the Nanao monitor, but the colors are brighter. Knobs in the back enable you to adjust vertical and horizontal size and position. You can display true circles and squares, but the image is slightly smaller than real life. The power switch is on the right side; a switch labeled "Text" allows you to switch between regular, blue, amber, and green displays. The monitor itself is compact, light, and comes on a tilt/swivel base.

The Taxan MultiVision 770 Plus comes in right behind the other two. The MultiVision's display isn't as crisp; it's a bit fuzzy and washed out. This seems to be the same model I reviewed in the December article and it has the same video artifact: a green line in the bottom-left corner of the screen. Colors bleed slightly along the top and left edges. The monitor displays objects in perfect proportion, though the images are slightly larger than real life due to its 69-dots-per-inch (dpi) resolution.

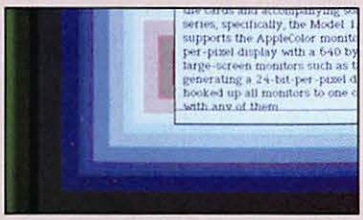
19-Inch AppleColor Replacement Monitors

Three of the replacement monitors are actually 19-inch CRTs that plug into the Apple Mac II Video Card. The result is a greatly enlarged display, typically

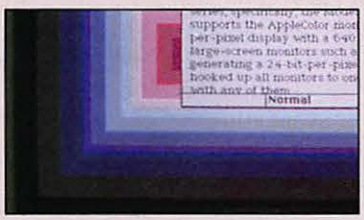
Dot Pitch	Vertical Scan	Horizontal Scan	Input
0.25mm	66.7 Hz	35.0 kHz	analog
0.31mm	48–60 Hz	15.75–37 kHz	TTL/analog
0.34mm	47–63 Hz	45–67 kHz	analog
n/s	47–85 Hz	15–34 kHz	TTL/analog
n/s	47–85 Hz	15–34 kHz	TTL/analog
0.28mm	50–80 Hz	15.7–35 kHz	TTL/analog
0.28mm	45–120 Hz	15–35 kHz	TTL/analog
0.26mm	60 Hz	48.8 kHz	analog
0.31mm	60 Hz	48.8 kHz	analog
0.31mm	50–90 Hz	15–34 kHz	TTL/analog



1. *The Taxan MultiVision is a bit fuzzier than the other AppleColor replacements. Images are slightly larger than real life.*

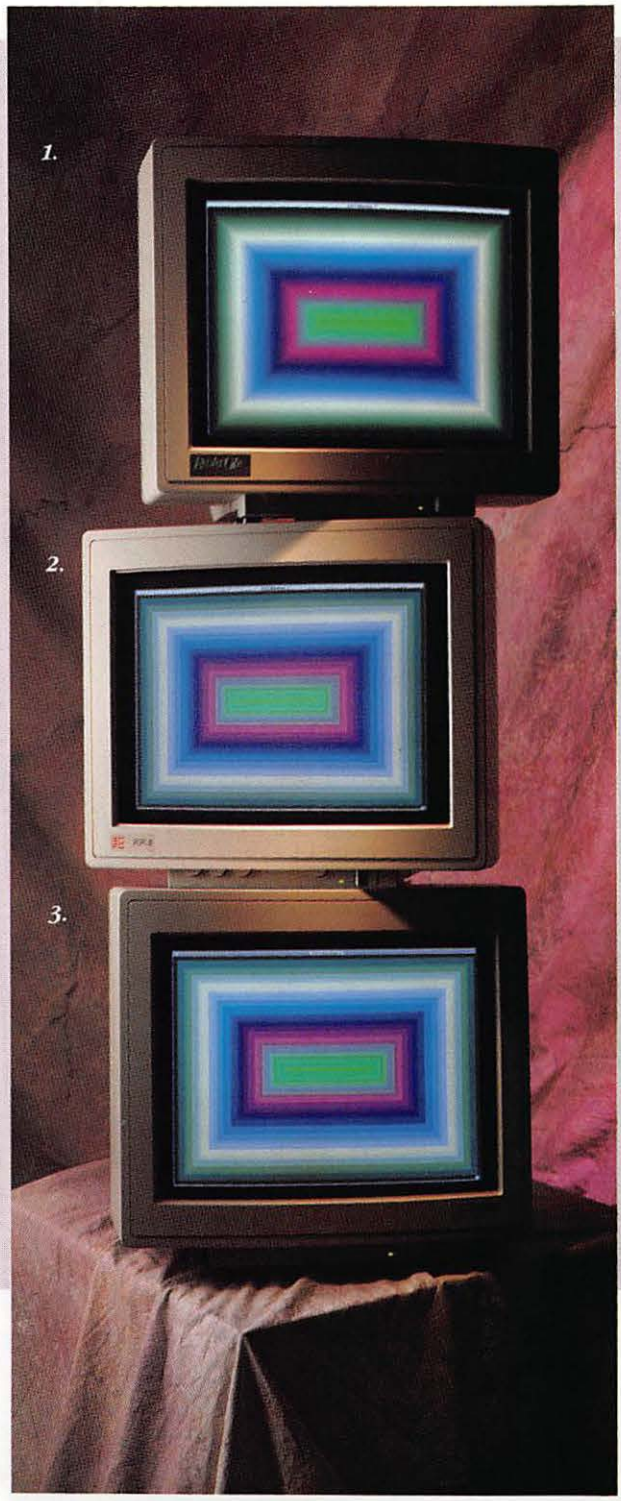


2. *The Nanao Flexscan finished second only to the AppleColor monitor. It displays objects at actual size with a 1:1 pixel aspect ratio.*



3. *The Princeton UltraSync's colors are brighter than the Nanao's, but the images are not as sharp and are slightly smaller than real life.*







1. *RasterOps's 19-inch Sony monitor with the ColorBoard 104, the only 24-bit color system available today.*



2. *The PCPC II card driving a 19-inch Sony monitor provides bold colors and crisp text in a high-resolution 8-bit color display.*



3. *SuperMac's Spectrum/8 (with 19-inch Sony monitor) supports 2, 4, 16, or 256 colors and is configurable for most monitors.*

half again as large as an AppleColor monitor's.

Two of the monitors come from Electrohome, the 1910 and the 1912. Both are 19-inch RGB monitors that plug into a Mac II Video Card (or equivalent). They have a power switch on the front along with brightness and contrast knobs. In the back are a *degaussing* switch for clearing the residual magnetic field that builds up, a switch for selecting analog RGB or TTL inputs, and knobs to adjust vertical and horizontal position and size. When the screen is adjusted for proper height and width, it displays objects about 1.5 times larger than real life. The displays are crisp, focused, with no real distortion (though there is some apparent bowing across the top, due to the curvature of the CRT). The Electrohome's display quality is better than

any of the other 13-inch monitors' above, though the gray background does have a brown tint to it, especially on the 1912.

The difference between the 1910 and 1912 is the phosphor used: a long-persistence phosphor on the 1912, and a short-persistence one on the 1910. I prefer the 1910: the colors are bolder, the phosphor has less of a brown tint, and there's no image persistence during animation. For example, when I ran an animation from Beyond Dark Castle, image tracing was apparent (if not bothersome) on the 1912, but was nonexistent on the 1910. Either monitor would make an excellent choice for trade shows, classrooms, and people with diminished visual acuity.

The third 19-inch monitor, the 7250, came from Conrac. I wasn't terribly impressed with the display at first: it was rather washed out, reminiscent of an overhead projector. After the recommended 30-minute warm-up period, the display improves, but not all that much, and it is never anywhere close to the quality of either Electrohome monitor. The aspect ratio is close to (but not exactly) 1:1, and the monitor displays images about 1.6 times larger than real life. The Conrac 7250 has three controls on the front: contrast, brightness, and a degaussing button. The contrast control can make text look crisp, but usually at the cost of color boldness. The power switch is half-hidden (literally) in the back; the usual control for switching between analog RGB and TTL inputs is back there as well.

Higher-Resolution Monitors

I received only one large screen add-on monitor designed for a video board producing more dots (higher resolution) than the Mac II Video Card. That was the Conrac 7351, a 19-inch analog RGB monitor. Like its cousin above, it has a 30-minute warm-up time that doesn't really improve the display much. It has the same rather washed-out color as the 7250 and doesn't really compare with the other higher-resolution monitors—which were all Sony Trinitrons.

To be exact, I received three Sony GDM 1952 19-inch monitors (with the PCPC, RasterOps, and SuperMac video cards) and one Sony GDM 1602 16-inch monitor (from SuperMac). They are all much better than the Conrac 7351; in fact, they are better than all but the AppleColor monitor (which, of course, only comes in a 13-inch model). The actual visual quality varies somewhat between the video cards—more on that in a minute—but in all cases, the displays are crisp, clean, and steady. Objects displayed on the 16-inch Sony are about 0.8 times their real-life size. The 16-inch Sony has an aspect ratio of 1.11:1, making the text look slightly taller than normal, while the 19-inch monitors all have aspect ratios of 1:1. All four Sony units have five controls on the front: vertical and horizontal convergence, vertical centering, contrast, and power. Finally, all four Sony monitors share two minor visual flaws: two very thin, visible mask wires cross the screen (one-third and two-thirds of the way down); and a faint, dark-and-light vertical banding crosses the standard alternating black-and-white (dithered) desktop background, but the banding doesn't appear over images, windows, text, and so forth.

8-Bit Color Video Cards

Of the four video cards I received, two were repeats from last December: the PCPC II and the SuperMac Spectrum/8. Both come with 19-inch Sony monitors. SuperMac also sent the 16-inch Sony, which it offers as an option.

The PCPC II hasn't changed much since I last reviewed it. It still gives a nice display, with few video problems—just some slight color bleeding along the upper right edge. You can set the board for 2 colors (black and white) or 256 colors. Display resolution is 1024 by 768 pixels, or exactly four times the size of the Macintosh SE display. Colors are bold, text is crisp—it all works just fine.

The SuperMac Spectrum/8 has improved significantly since I last looked at it. Many changes that had then been recently proposed have been implemented.

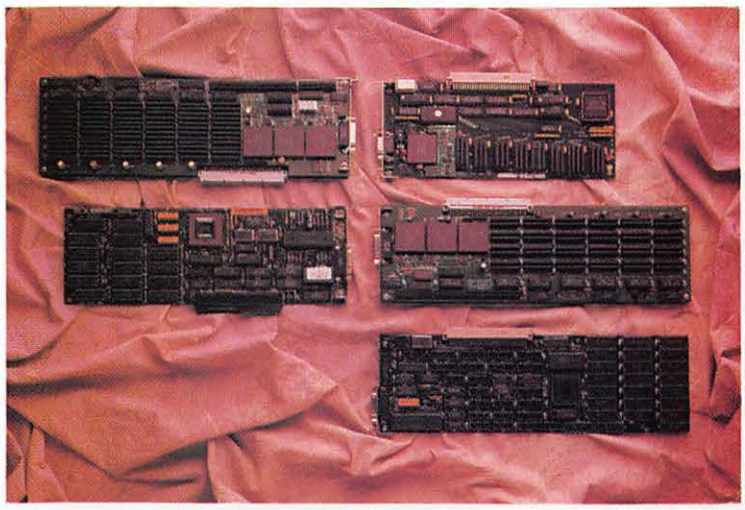
Color Video Cards

Video Card	Price	Resolution	Colors	Notes
Macintosh II 4-bit Video Card	$499	640 × 480	2, 4, 16	can be expanded to 8 bits (256 colors)
Macintosh II 8-bit Video Card	$648	640 × 480	2, 4, 16, 256	
PCPC II Graphics System	$1795	1024 × 768	256	
RasterOps ColorBoard 64	$2395	640 × 480	256, 16 million	software control of 24-bit (16 million color) mode
RasterOps ColorBoard 104	$3195	1024 × 768	256, 16 million	software control of 24-bit (16 million color) mode
SuperMac Spectrum/8 Video Board	$1595	1024 × 768	2, 4, 16, 256	comes configured for 1024 × 768 display; can support
		640 × 480		additional resolutions by replacing oscillator chip
		768 × 576		and selecting resolution via control panel

It supports 2, 4, 16, or 256 colors, in a 1024-by-768-pixel display. By changing the oscillator on the card and reconfiguring the card via the Control Panel, you can drive other monitors, including the AppleColor monitors that synchronize to multiple horizontal scan rates, the NTSC RGB monitors used in the U.S. and Japanese television industry, and the PAL RGB monitors used in Western Europe. (Users interested in video recording will be interested in the last two.) You can even program the card to handle just about any other monitor, if you obtain the proper oscillator and build your own cable. The Spectrum/8 with the Sony 19-inch monitor is the best of the card-monitor combinations I reviewed, except for the Spectrum/8 with the AppleColor monitor, and the Spectrum/8 plus the Sony 16-inch is even crisper and brighter than the Apple. Documentation is also excellent, explaining how to set up a system and how to configure the Spectrum/8 for different monitors. On top of all that, SuperMac throws in a copy of PixelPaint, a nifty paint program that lets you make use of those 256 colors.

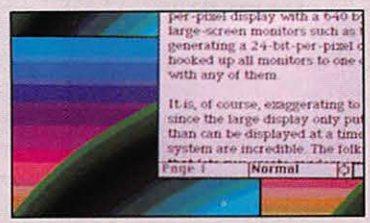
16 Million Colors

The other two cards, the RasterOps ColorBoard 64 and ColorBoard 104, are brand new; in fact, I received beta versions (0.95) of the cards and accompanying software. The ColorBoard 64 supports the AppleColor monitor (and replacements), generating a 24-bits-per-pixel display with a 640-by-480-pixel resolution. The ColorBoard 104 supports large-screen monitors such as the Sony 19-inch, Sony 16-inch, and Conrac 7351, generating a 24-bits-per-pixel display with 1024-by-768-pixel resolution. I hooked up all monitors to one card or the other; there were no problems with any of them (for more information on the ColorBoard 104, see *Reviews* in this issue).



It is, of course, exaggerating to say you can display 16 million colors at once; since the large screen contains only 786,432 pixels, that's how many colors you can display at a time. Even so, the images that come out of this system are incredible. The folks at RasterOps sent along a demo program that lets you create random images and make color separations of them. They also sent (in Scrapbook form) several 24-bit digitized images that you can paste into the demo program and display.

Even more amazing is the fact that you can run the Finder (and MultiFinder), as well as normal applications, under 24-bit mode. Things slow down a bit, since so much more drawing has to take place, and none of the existing color applications except LaserPaint currently takes advantage of 24-bit color. I tried using existing color software, however, while in 24-bit mode; most of it seemed to work just fine—sometimes perhaps more slowly. The only problem I had was with PixelPaint, but my version of PixelPaint was specific to the SuperMac Spectrum/8 board, so even that was excusable.

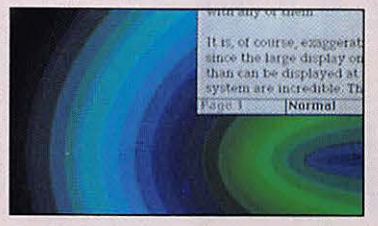


***1.** The Electrohome 1910 is ideal for meeting-room presentations. The monitor displays objects 1½ times larger than real life.*

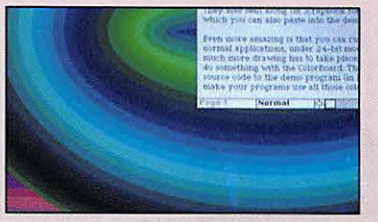


***2.** The Sony GDM-1602 provides the highest quality picture in a high-resolution 16-inch display.*





3. *The Conrac 7250 displays images at about 1½ times actual size. The colors are reminiscent of an overhead projector.*



4. *The Conrac 7351 is a higher-resolution version of the 7250, with many of the same color attributes.*

You can use the board as a regular 256-color board; in fact, that's the mode it comes up in whenever you boot or restart. You select the RasterOps option in the Control Panel to invoke 24-bit mode. This was still somewhat inconsistent in the version I got, but version 1.0 should allow you to switch between 8 and 24 bits.

This obviously is not a video board for everyone, but at only $2595 for the ColorBoard 64 and $3195 for the 104, it's pretty cheap for what it does. Of course, you still have to buy a monitor (preferably a Sony), but you end up with a system that a year or two ago would have cost five to ten times as much.

Color Picks

My current conclusions sound a lot like the ones I reached the last time I reviewed color monitors: the AppleColor monitor is the best 640 by 480 display; the Sony 19-inch (or, if you don't mind small text, the Sony 16-inch) is the best 1024 by 768 display; and the SuperMac Spectrum is the best 8-bit video card. However, the Electrohome 1910 is a great enlarged display for those of you who need one, and for you power users the RasterOps ColorBoards are definitely worth looking at. □

See *Where to Buy* for contact information.

Bruce F. Webster is a Macworld *contributing editor and freelance writer living in the redwoods near Santa Cruz, California.*

Staying Alive



by Bruce F. Webster

Well, you heard the news a few months ago, and you knew it was all over. Apple cut the list price of the Macintosh Plus down to $1799, a clear sign that the Plus's days are numbered. Or are they? It may just be that Apple sees the burgeoning home market for cheap PC clones and wants to get a share of that. In either case, the Mac Plus, once the flagship (and the savior) of the Macintosh product line, has become the low-end product, a poor—or at least inexpensive—cousin to the Mac SE, the Mac II, and whatever else Apple might bring out in the near future.

The Mac Plus is threatened with becoming a dead-end product. The Mac SE has far more in common with the Mac II than with the Plus, and those first two are what developers are focusing on. Many third-party products now divide Macs into two groups: the 128K, 512K, 512KE, and Plus; and the SE and II. And we all know what happened to the 128K and 512K, don't we?

Not to worry. Your Mac Plus isn't going to break down overnight; it's served you just fine up till now, and it's not going to stop working just because of its changing market position. In fact, if Apple lowers the price enough, it may sell very well in some new markets, such as education and home.

Most important, don't think you're stuck with a dead-end system. While the Mac Plus wasn't designed for expansion, it can be expanded nevertheless. And I'm going to show you how to do it. I'm going to take a Mac Plus and give it a face-lift of sorts. And by the end of the article, you won't feel bad at all.

First Things First

Get a hard disk. Seriously. Or, in this case, Cirrus-ly. La Cie sent us not one, but two of their Cirrus hard disk drives, one 40MB and one 60MB. These are small, slick units that sit by the side of a Mac Plus. They're about the same depth as the Plus, half the height, and two inches wide. You can stack them horizontally or vertically, they don't make much noise, and they're fast. If this were a formal review of hard

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Bruce F. Webster is a Macworld *contributing editor and freelance writer living in the redwoods near Santa Cruz, California.*

PHOTOGRAPHS BY FRED STIMSON



Add on to boost performance and extend the life of the Mac Plus

Improving on the Basics

DataDesk's Mac-101 keyboard and MSC's A+ mouse can improve responsiveness tremendously. If you don't already own one, a hard disk drive (like the Cirrus 40MB and 60MB units shown here) is the best investment you can make to revitalize the Plus's performance.

disks, we'd list two dozen of them, with cost, capacity, features, and access times. But it's not, so we'll just say that the Cirrus is fast enough for all practical purposes, and it beats the heck out of working with floppies.

By the way, you can hook up the two Cirrus hard disks—or, for that matter, any two SCSI drives—to the Mac Plus at the same time. In the case of the Cirrus drives, you must open up the cabinet of one disk, move two jumpers, and then close the cabinet back up. That changes the SCSI ID of that hard disk from 1 to 2. Careful closing the cabinet, though; I had some difficulty stuffing all the wires back inside.

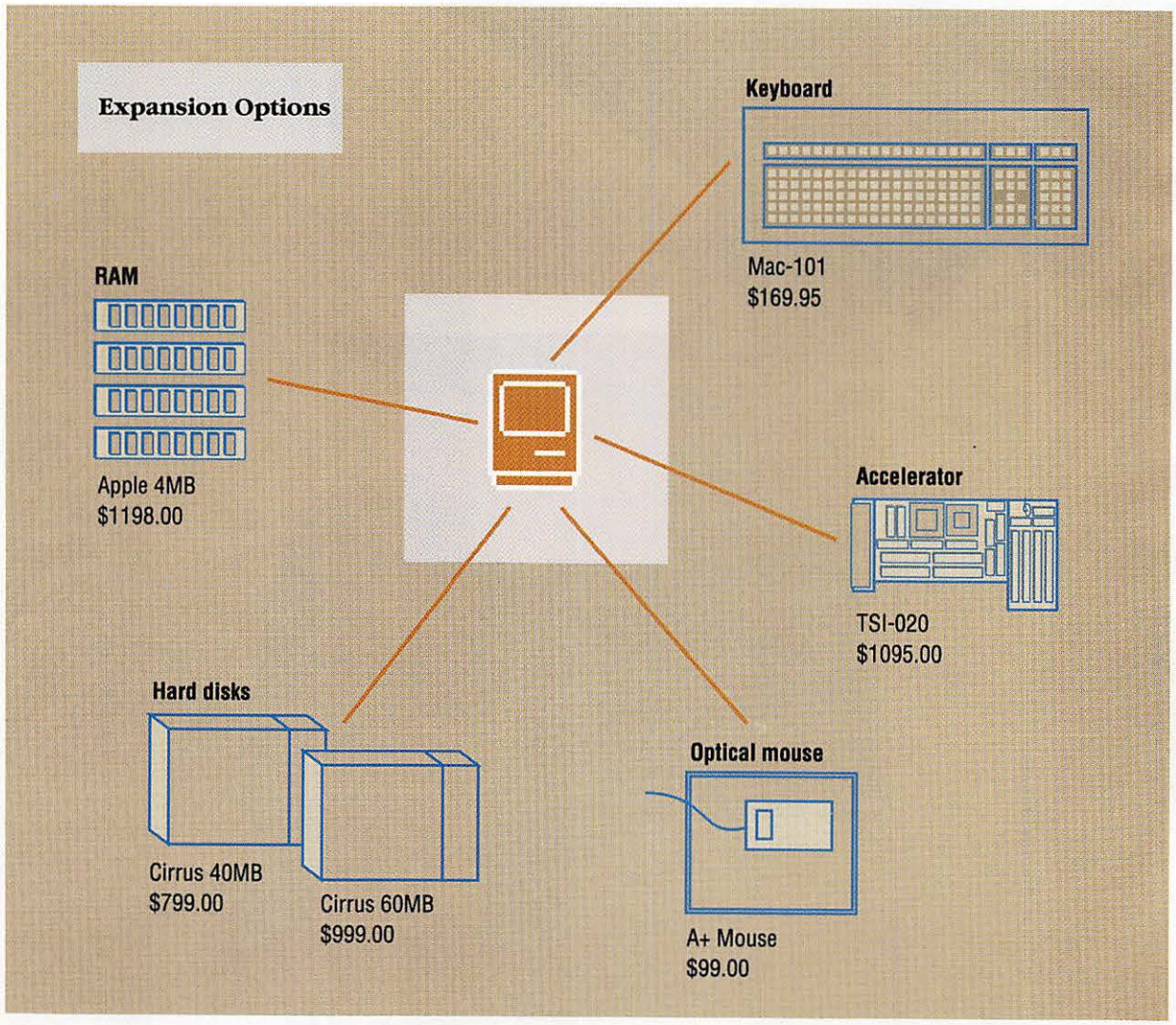
The result is worth it: 100MB of online storage, easily accessible. The Cirrus drives come with volume-management and remote-disk-serving software (called SilverServer) that makes it easy to organize that space into manageable chunks. Or, if you want, you can set up the two drives to look like a single volume. Cost of the drives: $739 for the 40MB Cirrus, $839 for the 60MB.

Expand Memory

Next thing you need is more memory. That way, when your friends start dropping comments about having 2MB or 4MB on their SEs (or even more on their IIs), you can casually yawn and say, "Yeah, I really like having 4MB on my Mac Plus."

Of course, it isn't going to come cheap. Thanks to our government's efforts to protect the American semiconductor industry, RAM prices—after a steady decline for years—are now on the upswing. The strength of the yen doesn't help, either. You can expect to pay anywhere from $1200 to $2400 for 4 Single Inline Memory Modules (SIMMs), each containing 1MB of RAM. They plug into the SIMM sockets on the Mac Plus system board. Instructions for adding RAM to the Mac can be found in the May 1988 issue of *Macworld* ("Installing Memory"), while a comprehensive listing of companies selling RAM can be found in the February 1988 issue ("New Life for an Old Mac").

In this case, we went with Apple's product. We got two packages, each containing two 1MB SIMMs. Installation required a specialized Mac opener and a bit of caution, but otherwise went well. Cost: $849 per 2MB, or $1698 altogether. Note that if you're getting an accelerator board, however, you may not need (or be able to use) the extra memory on the Mac Plus



system board. Be sure to check this out with your dealer.

Trade In Your Keyboard

After three years of keyboards with no function or cursor keys, Apple came out with not one but two honest-to-goodness professional keyboards. That's the good news. The bad news is that they only work on (you guessed it) the Mac SE and the Mac II. Your Mac Plus is stuck with that plain ol' Macintosh keyboard.

Or is it? One alternative from Olduvai, AdBridge, lets you attach keyboards for the SE and II, or for that matter any Apple Desktop Bus device, to the Plus. Alternatively, the folks at DataDesk International have a keyboard for the Mac Plus that puts either of Apple's new offerings to shame. The Mac-101 Keyboard sports 101 keys, including 15 function keys, a full numeric keypad that looks amazingly like a PC's, a separate set of cursor keys that actually work, and a number of special-purpose keys. It doesn't, however, have a Ctrl key, though one presumes the SE/II model does. (Yes, there is a model for the SE and II.)

The keyboard has a nice feel to it. I always thought I liked my keys a bit bouncier, but I seem to type faster on the Mac-101 than on the regular Mac Plus keyboard. More important, though, is that the Mac-101 supports keyboard macros. It comes with several predefined macro files, including one for Microsoft Word 3.0, and an overlay template for the function keys. The keyboard also has a desk accessory that lets you create your own keyboard macros. In other words, you can map a sequence of characters, as well as window commands, to a single key. The Mac-101 comes with excellent documentation (some 50 pages' worth) telling you how to get the most out of the keyboard. I may get one of these for the Mac II. Cost of the Mac-101 (for all Mac versions): $169.95.

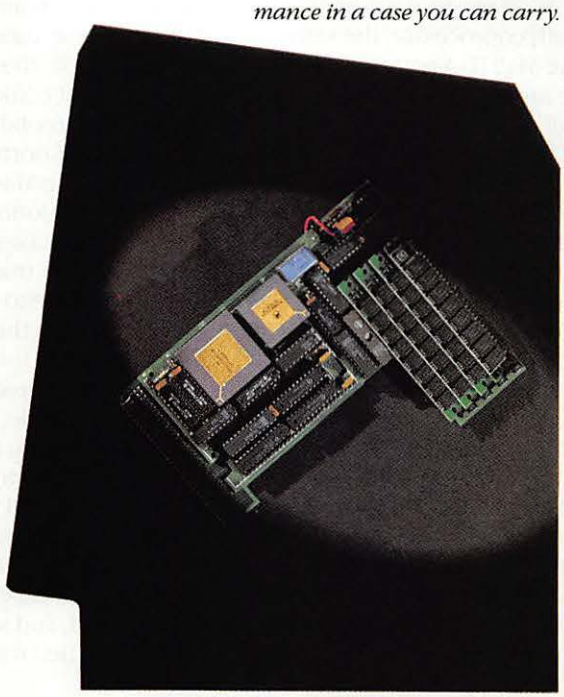
Get a Faster Mouse

Here's a way to show up those upper-class-Mac snobs. Throw away your old mechanical Apple mouse and get an optical one. This gadget works by shining light onto a pad containing a grid pattern and reading the reflections. The bad news is that an optical mouse works only on a special precision pad. The good news is that an optical mouse moves and handles a lot smoother than the usual mouse. It's also very easy to make fine movements—especially handy when drawing. And you don't have to open it up and clean the gunk off the rollers every month or so.

The optical mouse I tried is the A+ Mouse from MSC Technologies. No real installation; just plug it into the regular mouse port, put it on its pad, and you're ready to go. Cost of the A+ Mouse: $99. If your SE and II friends get jealous, they can buy one, too, but it'll cost them extra: $129 for the A+ ADB Mouse.

Horsepower to Go

If it's speed you're after, accelerators like the TSI-020 (shown here) can put Mac II performance in a case you can carry.



Add On or Trade Up

So, here we are with the Mac Plus. It now has 4MB of RAM, somewhere from 40MB to 100MB of hard disk storage, a full-size keyboard (complete with macro facilities), and an optical mouse. This is a system that will stay productive for a long time. Still, you might want something more, something with *oomph*. And so you opt to get an accelerator board for your Plus.

This is a major upgrade and not without pitfalls. There are significant compatibility problems with 68020-based accelerators—just as there are with the Mac II—though the compatibility problems are slowly being resolved. More important, installing an accelerator means messing around with the Mac Plus system board. Yeah, you had to do that for the memory upgrade, but that was a breeze compared to this. You may want to have a dealer do it, or possibly even the firm that makes the upgrade. (I chose to live dangerously and do it myself.)

This is also the point to stop and ask yourself about buying a Mac II. TEK Computer in San Francisco is currently selling a Mac II with a monochrome monitor, Apple video card, standard keyboard, 1MB of RAM, and a 40MB hard disk, for under $4000. Given the upgrade prices we're

looking at, especially for accelerators, you might be better off selling the Mac Plus and buying a Mac II. However, assuming you want to upgrade the Plus, let's add an accelerator.

Boost Performance

An accelerator board gives the Mac Plus a new central processing unit (CPU). Typically, it's a 68020 processor, sometimes with a 68881 math coprocessor, the same duo found in the Mac II. A few accelerators simply offer the same 68000 processor as the Mac Plus, but running at a higher clock speed—sort of like playing LPs at 78 rpm instead of 33⅓. When choosing an accelerator, look carefully at the various features and options: the processor, the clock speed, a math coprocessor, memory expansion, memory usage.

Macworld has covered accelerators in many articles over the past year, including "Beefing Up the SE," September 1987, and several follow-up reviews. An extensive list (and discussion) appeared in "New Life for an Old Mac" in the February 1988 issue.

For this article, I chose an upgrade that hadn't been reviewed yet: the TSI-020 accelerator, from Total Systems Integration (TSI). Unfortunately, my experience wasn't quite representative of what you're likely to encounter. The problem was I asked TSI to send me an accelerator that had already been installed on a system board, because the installation involves soldering connector pins to the Plus's existing 68000. The "piggyback board"—a circuit board containing the 68020, 68881, and up to 4MB of RAM—then mounts to the connector pins. TSI was out of Mac Plus system boards, however, and the company sent an accelerator mounted on an old 512K system board. That, of course, caused a couple of major problems. First, the 512K board has no SCSI port, so I couldn't hook up the hard disks again. Second, the 512K board has a different set of ports on the back, so I couldn't put the Mac Plus case back on.

TSI had solutions for both problems. First, it sent me a special adapter that runs a SCSI cable out from the piggyback board. That allowed me to hook up the hard disks. Second, TSI sent the back of a Mac 512K case, so I could close up my Mac.

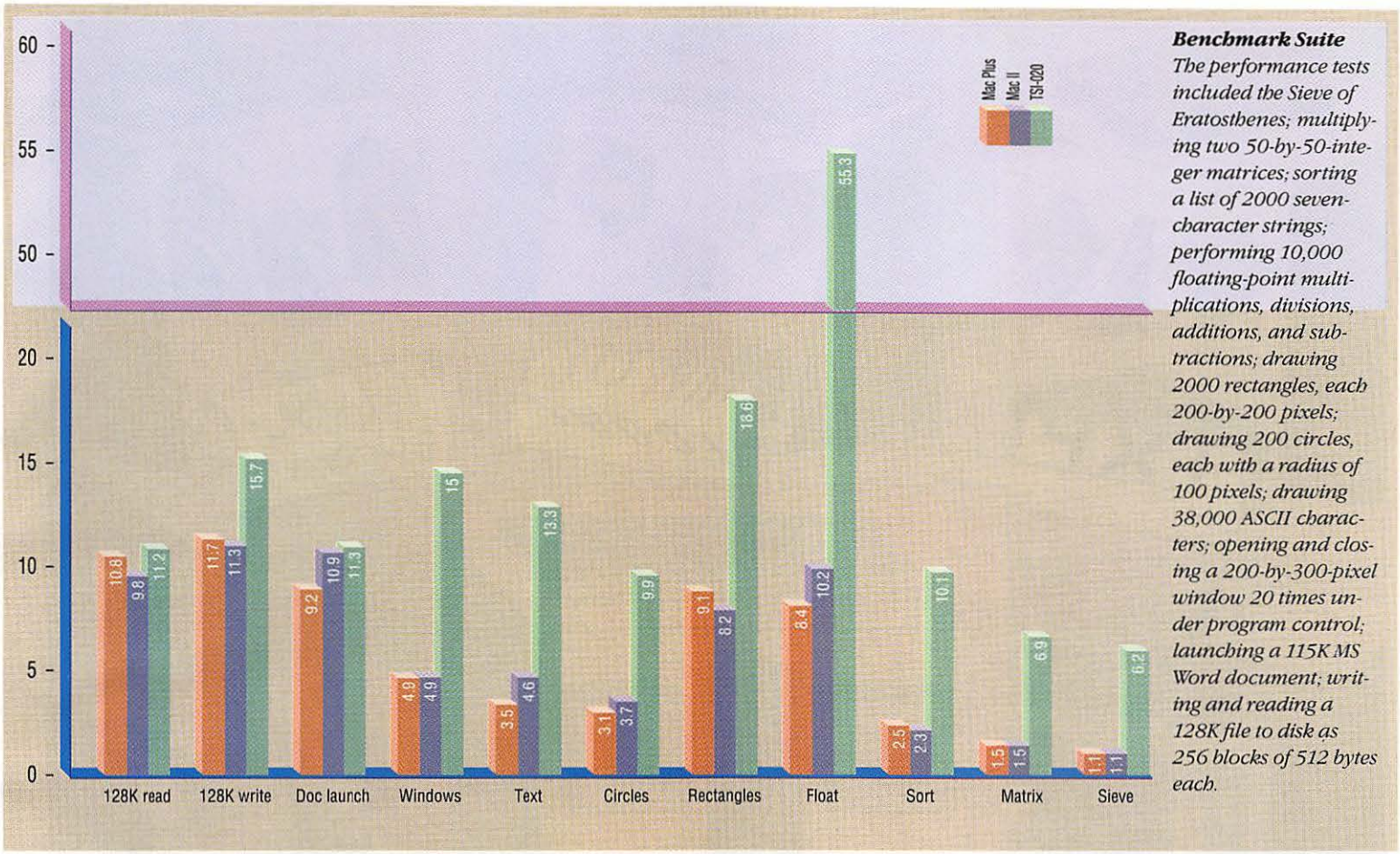
Though TSI recommends that a dealer install the upgrade, I went through the procedure to see what it involves. The upgrade itself is fairly easy to perform, if a bit nerve-racking. I removed the back of the case (being extremely careful not to touch the flyback cable—I value my life), unplugged the power and disk drive cables from the system board, and slid it out of the machine. I installed the auxiliary power supply (from TSI) and hooked the clips to the Mac's analog board. I pried the Mac Plus ROM chips out of the Mac Plus system board and inserted them in the 512K board from TSI. I then inserted the upgraded system board; it doesn't slide in, so you have to lever it into place from underneath. I connected the necessary wires and cables, put the Mac 512K case on, plugged everything in, and powered up. It worked!

Performance using the TSI-020 is equivalent to and occasionally better than a Mac II's in most areas. At first the TSI-020 didn't appear to support automatic access of the 68881 math coprocessor. However, I discovered a utility that routes Standard Apple Numerics Environment (SANE) calls to the 68881, which speeds up floating-point operations.

"Benchmark Suite" shows some simple benchmarks performed on the Mac II (running MultiFinder), the TSI-020 (running its system software), and the Mac Plus (running pre-MultiFinder system software). The document launch involved double-clicking on a 115K Microsoft Word document and timing how long it took for the document to appear, with the cursor at the beginning of the file. All disk benchmarks were done using an internal 800K floppy drive. The benchmarks should be treated as a general indication of relative perfor-

Accelerator Boards for the Macintosh Plus

Company	Product	Processor	On-board Memory	Floating-Point Unit
Levco	Prodigy 4	16MHz 68020	4MB RAM	optional
MacProducts USA	Magic 020	12.5MHz 68020	none	included
Network Specialties	Jump 020	16MHz 68020	1MB to 4MB	optional
Radius	Radius Accelerator 16	16MHz 68020	32K cache	optional
Ryad	MacEngine GT	16MHz 68000	up to 4MB	no
Ryad	MacEngine Turbo	16MHz 68020	up to 4MB	optional
Spectra Micro Development	MacAccelerator	12MHz 68020	none	included
Total Systems Integration	TSI-020	16MHz 68020	up to 4MB	included



Benchmark Suite
The performance tests included the Sieve of Eratosthenes; multiplying two 50-by-50-integer matrices; sorting a list of 2000 seven-character strings; performing 10,000 floating-point multiplications, divisions, additions, and subtractions; drawing 2000 rectangles, each 200-by-200 pixels; drawing 200 circles, each with a radius of 100 pixels; drawing 38,000 ASCII characters; opening and closing a 200-by-300-pixel window 20 times under program control; launching a 115K MS Word document; writing and reading a 128K file to disk as 256 blocks of 512 bytes each.

Expansion Port	Other	Price
MegaScreen Plus	clip-on board; includes fan, power supply, SCSI port, RAM disk	$3099
none	kit; chips not included	$99
Stretch Screen and Stretch Projector	clip-on board; CPU can run at 16MHz or 24MHz	from $1595
none		$995
none	inludes fan, power supply	from $595
none	includes fan, power supply	from $695
The Big Picture	clip-on board; includes C compiler and assembler	$695
none	clip-on board; includes fan, power supply	from $1295

mance, not as exhaustive, scientific tests.

Cost of the TSI-020 upgrade, with a 16Mhz 68020, 16MHz 68881, and 1MB of RAM: $1295.

Well Worth the Effort

The total cost for the upgrade without the accelerator and with 4MB of RAM from Apple was $2706. The total cost with accelerator and auxiliary power supply (but without the Apple RAM) was $2453. Even though I usually work on a Mac II with a large screen, I found the Mac Plus (with no accelerator) very acceptable to work on; funny what a lot of memory and disk space can do. With the accelerator, it was wonderful.

The bottom line is that you can keep your Mac Plus running and productive for quite some time. Just because its price is coming down—even if Apple discontinues it—the Mac Plus isn't ready for the scrap heap yet.

See *Where to Buy* for contact information.



SCOTT BALDWIN

Where Are the Clones?

What are these so-called PostScript clones, anyway, and what's taking them so long?

by Brita Meng

I admit it—when I heard that printer manufacturers were developing laser printers that could print PostScript files without using Adobe Systems' page-description language, I nearly jumped for joy. The companies were promising the output quality of a PostScript printer, better performance, and a lower price. But, more than a year since the printers were first hyped, you and I are still waiting for the first PostScript clones.

Manufacturers know that if they don't ship product, they sow skepticism: How similar can their printers be to printers equipped with Adobe's (and no one else's) PostScript? Can a clone outperform the original? Will the fonts be as good as PostScript fonts? Will the clones really be less expensive than PostScript printers?

You'll have to wait a little longer still for answers to those questions. Developers working on printer controllers that copy the way a PostScript-equipped controller works have discovered how difficult it is to clone PostScript. To be called compatible, a PostScript clone can't just print pages that look as if they were produced by, say, an Apple LaserWriter. A clone must go beyond that and actually duplicate how a PostScript printer handles text, graphics, and special effects. You should be able to connect a clone to a Mac or an AppleTalk network and drive it from Mac applications as if it were a LaserWriter.

Meanwhile, you should consider yourself lucky, because the first PostScript clones are strictly for IBM PC users, who will serve as de facto laboratory mice in the test of PostScript compatibility. But sooner or later you, too, will have to decide to clone or not to clone.

What to Expect

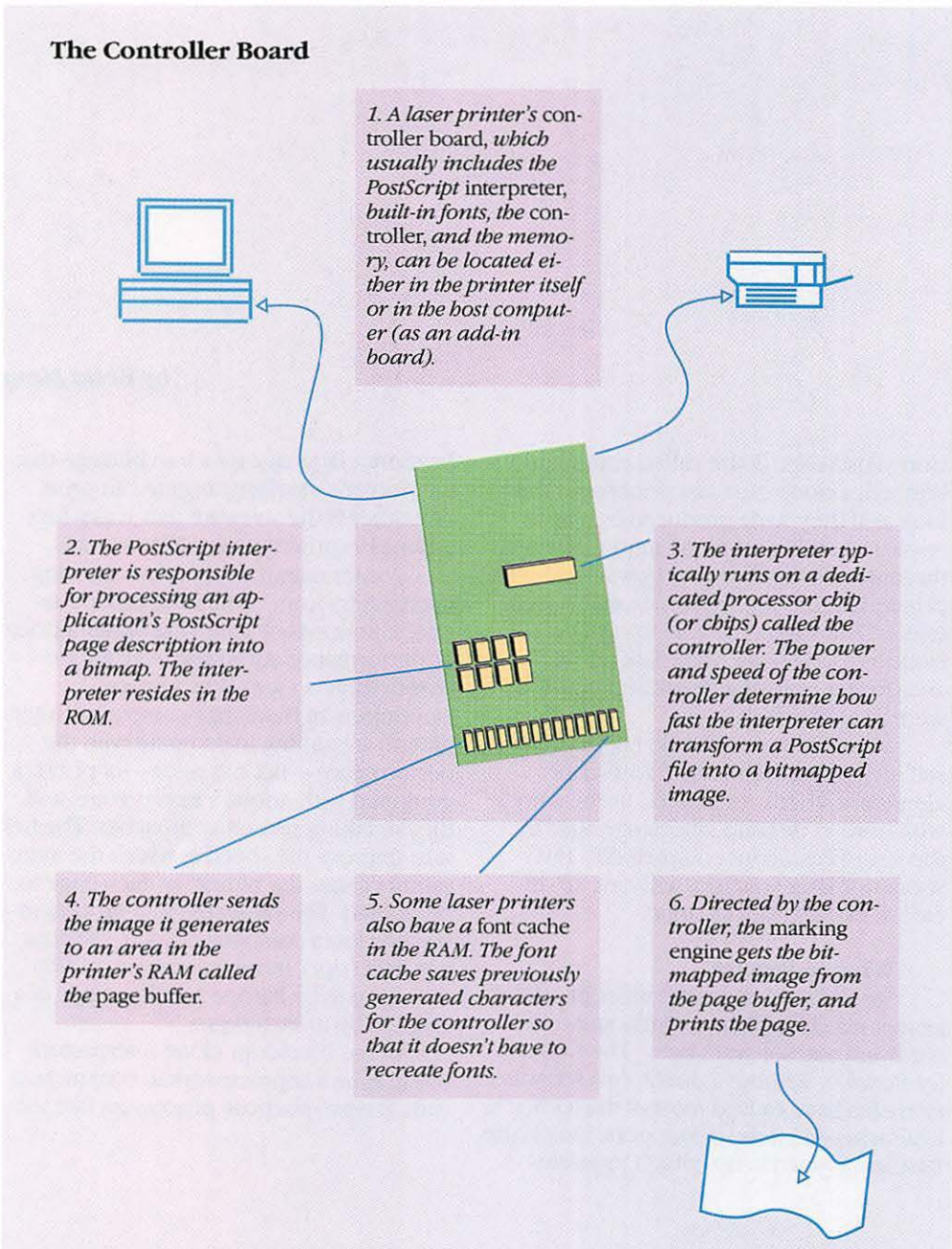
To take advantage of PostScript, a laser printer needs a specific combination of hardware and software (see "The Controller Board"). Without a doubt, two software elements have caused most of the technical headaches for clone developers. One is the PostScript *interpreter,* which translates PostScript language files into bitmaps that the printer's *marking engine* can print. The other is the software that scales font outlines to print type in different sizes.

Printer manufacturers are licensing interpreters from companies other than Adobe in hopes of achieving either a price or performance advantage over Adobe-based printers (see "Why Clones?"). Developers of PostScript-compatible interpreters are aiming to compete with the performance—not the price—of printers equipped with Adobe's interpreters, and they're taking several approaches. The first is to improve the speed at which the interpreter creates the bitmap of each page to be printed. This *rasterization* process involves a lot of computation—at 300 dots per inch (dpi), more than seven million dots have to be mapped in the image of a single 8-by-10-inch page.

Some PostScript-clone interpreters use graphics coprocessors in conjunction with general-purpose processors like the

Motorola 68000 to accelerate PostScript processing. For example, the 720 IQ laser printer from Printware in Saint Paul, Minnesota, uses two 68000 chips and a proprietary coprocessor on its controller. Other clones are employing proprietary chips, such as reduced instruction-set computer (RISC) chips or application-specific integrated circuits (ASICs), specially designed to handle the PostScript language. The interpreter from Raster Image Processing Systems (RIPS) of Boulder, Colorado, is optimized to run on a proprietary RISC chip; Eicon Technology of Montreal, Canada, is working on a printer controller based on transputer technology.

A second approach is to employ a faster marking engine in the laser printer. The LaserWriter IINTX laser printer—even with a 68020 on its controller—can print only 8 pages per minute. Two laser printers from Kentek Information Systems in Allendale, New Jersey, the K3 and K4, use the PostScript interpreter clone developed by Phoenix Technologies in Norwood, Massachusetts. The K3 is a 24-page-per-minute printer; the K4 is a 24-side-per-minute printer.



The third way to enhance PostScript clones' performance is to give them printing resolutions higher than the 300-dpi laser printer standard. The PrintWare 720 IQ, for example, prints at 1200 dpi, and other PostScript-clone printers are designed to print at 1600 or more dpi. But all these approaches cost money, so don't expect PostScript clones to offer significant savings over PostScript-equipped laser printers.

Seeking less expensive solutions, some developers are working on software approaches to giving non-PostScript printers PostScript capabilities. General Computer Corporation in Waltham, Massachusetts, for example, offers a "PostScript brain transplant" that adds a clone interpreter to its QuickDraw Personal LaserPrinter and costs about $2000.

How Compatible Is Compatible?

No matter the perks of price or performance, PostScript clones, almost by definition, are only as good as they are compatible with PostScript printers. A developer working on a clone of a PostScript interpreter must produce software and hardware that can take PostScript code generated by an application program and create a bitmap for the printer's marking engine, and that bitmap must be as close as possible to the bitmap produced by an Adobe interpreter using the same code.

For a PostScript clone to be compatible, its interpreter must be able to recognize all PostScript language commands defined in Adobe's *PostScript Language Reference Manual* (also called the Red Book). The interpreter must be able to execute those commands on the printer according to Red Book definitions. The Red Book, however, is incomplete. Adobe's interpreters have their own undocumented idiosyncracies. The PostScript operator *eexec,* for example, is not included among Adobe's published definitions. The eexec operator enables PostScript programmers to modify existing PostScript commands, add additional commands to the interpreter, and encode and decode font information. It has also been used for patching PostScript bugs to avoid upgrading a laser printer's read-only memory (ROM).

Macintosh system software designed for a specific PostScript printer (Laser Prep for the LaserWriter, for example) complicates matters further. Laser Prep defines some extra PostScript features, not included in the LaserWriter's ROM, written specifically for the LaserWriter. In fact, each

Why Clones?

PostScript printers are in high demand. Users want to buy them, and printer manufacturers want to sell them. Equipping their printers with PostScript means that manufacturers have to license Adobe's proprietary interpreter and Adobe's proprietary fonts. Because Adobe works closely with each printer manufacturer to develop the right PostScript interpreter for its printer, high demand means long hours for Adobe engineers and a long queue of eager printer manufacturers waiting impatiently for Adobe to get around to them. Developers of PostScript-compatible interpreters have offered those manufacturers another option.

Interpreter developers (see "For More Information") claim that their clones offer significant advantages to printer manufacturers and (by extension) to you. In the first place, they say, manufacturers must wait a year for Adobe to develop a PostScript interpreter specifically for their printers—time that printer companies would rather spend selling their printers.

Second, clone makers claim that Adobe's licensing and royalty fees are excessive—$100,000 down and a $2 million minimum over two years are the figures most often cited. Industry analysts at Datek in Newtonville, Massachusetts, say that 7 percent of each PostScript printer's price tag goes to Adobe.

In addition to charging high fees, say clone makers, Adobe offers a slow interpreter. They claim that graphics coprocessors, reduced instruction-set computer (RISC) chips, and application-specific integrated circuits (ASICs) in printer controllers improve printer performance. All the clone makers currently claim that their printer controllers are faster than Adobe's.

Adobe denies all those allegations. Clinton Nagy, national sales manager, says that generally there is not a year-long wait for an Adobe interpreter. The development time depends on the complexity of the project. If a printer vendor wants a high-speed, high-resolution, color laser printer, it could take a year or so, according to Nagy. On the other hand, he points out, AST Research was able to deliver finished printers to stores only 90 days after Adobe and AST signed a PostScript contract.

Nagy also disputes the charges of excessive Adobe royalty and licensing fees. He claims that clone developers themselves have acknowledged the high cost of research and development involved in cloning PostScript interpreters, let alone in developing the original itself. Steve Butterfield, vice president of marketing and sales at another clone developer, Bauer Enterprises in San Jose, California, estimates that Bauer's effort to make a PostScript-compatible interpreter is easily a 20-worker-year project.

Meanwhile, Adobe is improving PostScript performance. According to Nagy, much of the high-performance code developed for Display PostScript will be used in Adobe's PostScript interpreters. Adobe is also working with the same graphics coprocessors, ASICs, and RISC chips that many of the clones are using to improve performance.

Adobe PostScript interpreter includes commands specific to the printer for which it was developed. These *device-level* commands depend on the paper tray, document feeder, and collator features, among others, that a manufacturer would like to include with its printer.

By the end of this year, Adobe expects to have more than 70 implementations of its own PostScript interpreter installed in laser printers. Thus, clone vendors face more compatibility questions. Exactly which PostScript printer do they want to clone? And which Adobe interpreter version do they choose for that printer? (Many clone developers have decided to emulate Adobe's implementation of PostScript for the LaserWriter, but there are at least two versions of LaserWriter interpreters. The original LaserWriter included version 38; the most current LaserWriter interpreter, used in the IINT models, is version 47.)

There are also bugs in Adobe's own interpreters. In some cases, software programmers have accommodated those bugs in their applications. Clone makers must decide whether they should implement those Adobe bugs in their interpreters so that such applications print documents as expected on the clones. According to Mike Drewry, technical marketing support manager at Control-C Software in Beaverton, Oregon, Control-C's PostScript interpreter clone includes all the Adobe bugs in version 38; the company is now working on its version 47 clone.

Aside from System prep files and different versions of PostScript, clone makers also have to consider printer drivers. All Mac applications use the Mac's LaserWriter driver to send documents to a laser printer. If a PostScript clone can't work with that driver, applications won't print on the clone. You'd be forced to use only those

For More Information

Interpreter Manufacturers

- Adobe Systems, P.O. Box 7900, Mountain View, CA 94039-7900. 415/961-4400.
- Bauer Enterprises, 1340 Saratoga-Sunnyvale Rd., #201, San Jose, CA 95129. 408/446-4944.
- Control-C Software, Inc., 9205 S.W. Gemini Dr., Ste. A, Beaverton, OR 97005. 503/641-8128.
- Eicon Technology Corp., 2196 32nd Ave., La Chine, Quebec, Canada H8T 3H7. 514/631-2592.
- Imagen Corp., 2650 San Tomas Expwy., Santa Clara, CA 95051. 408/986-9400.
- Phoenix Technologies, Ltd., 320 Norwood Park S, Norwood, MA 02062. 617/762-5030.
- Printware Inc., 1385 Mendota Heights Rd., Saint Paul, MN 55120. 612/456-1435.
- Raster Image Processing Systems (RIPS) Inc., 4665 Nautilus Court S, Boulder, CO 80301. 303/530-2910.

Font Vendors

- Bitstream Inc., 215 First St., Cambridge, MA 02142. 617/497-6222.
- Compugraphic Corp., 200 Ballardvale St., Wilmington, MA 01887. 617/658-5600.
- URW, via The Company (U.S. marketing arm) 400 World Trade Blvd., Boston, MA 02210. 617/439-5347.

Printer Vendors

- Birmy Graphics, 2244 N.W. 21 Terr., Miami, FL 33142. 305/633-5241.
- Imagen Corp., 2650 San Tomas Expwy., Santa Clara, CA 95051. 408/986-9400.
- Itek Graphics, 34 Cellu Dr., Nashua, NH 03063. 603/889-1400.
- Kentek Information Systems Inc., 6 Pearl Ct., Box 78, Allendale, NJ 07401. 201/825-8500.
- Printware Inc., 1385 Mendota Heights Rd., Saint Paul, MN 55120. 612/456-1435.

Mac applications that can print through a printer driver specific to that clone. To simplify matters, PostScript printers other than the LaserWriter, like QMS's PS-800 Plus and Texas Instruments' OmniLaser 2108, use the standard LaserWriter printer driver.

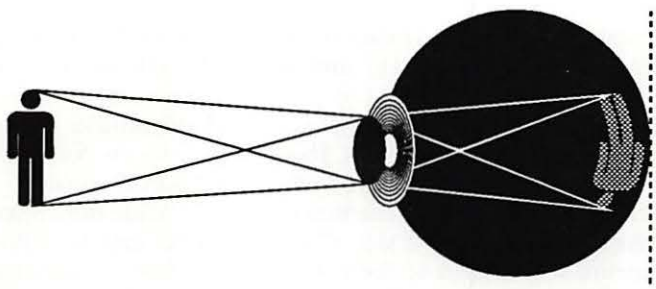
Networking is yet another issue. According to Doug Macrae, chair of General Computer, developing a printer that works over AppleTalk is not a simple task. Apple and Adobe worked together to ensure that the LaserWriter could be shared over AppleTalk; General Computer also worked closely with Apple to put its Personal LaserPrinter on AppleTalk networks. Although several printers can be connected to a Mac via the serial port, you can't share those printers. You don't want to buy a clone only to find that you can't use it over AppleTalk.

Is It Type or Is It Hype?

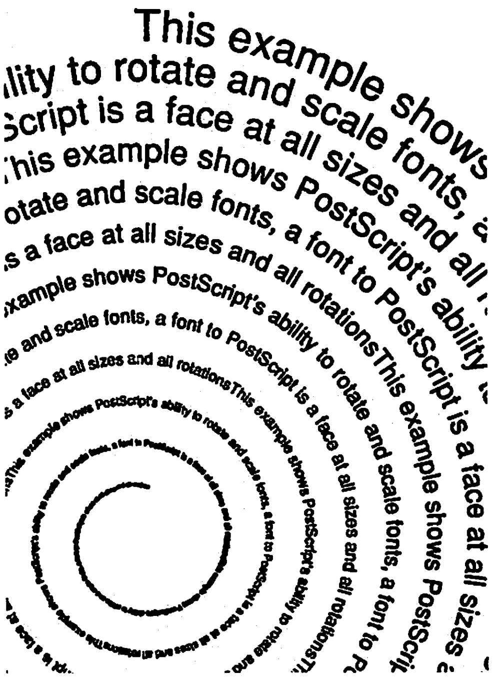
Font quality is the major issue faced by PostScript clone developers, and it will be the major issue that potential customers will be considering. Many of the first clones (Printware's 720 IQ, the Ultre Typesetter from Birmy Graphics, and Itek Graphics' IGX 7000) did not print at 300 dpi, but rather at higher resolutions—1200 dpi and up—that allow for smoother edges and better definition in type characters.

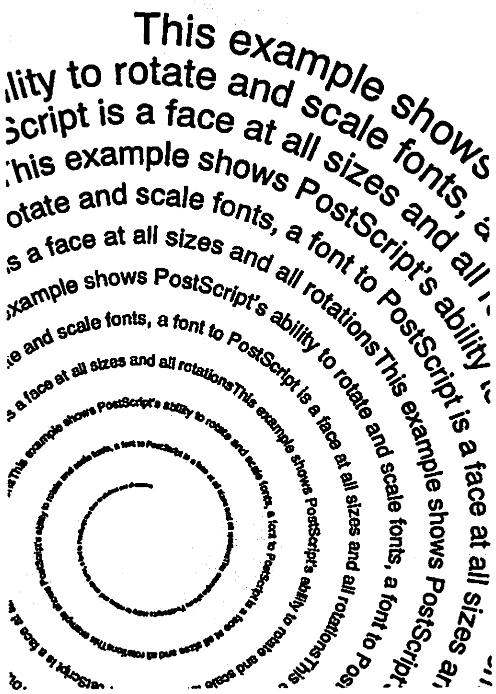
Producing well-defined characters in various type sizes—especially small text faces and large display type—at 300 dpi has been Adobe's (and PostScript's) advantage all along. The clone developers' problem lies in the rasterization process that transforms an outline font into bitmapped characters. The outline is scaled to the selected type size and then filled with dots. To maintain its fonts' design and edge definitions, Adobe uses carefully guarded "hints" in its interpreters that clone makers can only approximate, some more successfully than others.

To achieve the same type quality available from PostScript printers, clone manufacturers must either develop their own scaling and rasterization techniques or search for font vendors with comparable technology. Most clone makers are not type experts. Many have gone to established manufacturers of digital type for PostScript-compatible fonts—Bitstream in Cambridge, Massachusetts; Compugraphic in Wilmington, Massachusetts; and URW in Hamburg, West Germany, among others.



Graphic Output
An example of graphic output from the RIPS PostScript-compatible interpreter.





Print Samples
The print sample on top was printed using the Adobe PostScript interpreter on an Apple LaserWriter. The bottom sample was produced using the RIPS PostScript-compatible interpreter.

These digital type "foundries" have their own techniques for font scaling, and of course each claims that its type is superior to Adobe's—even in the very large and very small sizes that really put font-scaling techniques to the test.

Print quality aside, compatibility with Adobe fonts means at the very least that third-party fonts match the *character widths* of the corresponding Adobe fonts. A character's width defines the amount of space on either side of, above, and below the character. Character widths are part of the information that defines each font, and they influence other typographic elements such as line breaks and the spaces between lines, words, and letters. Without matching character widths, you cannot use an allegedly PostScript-compatible font when you're proofing a document on a PostScript-clone printer before sending it to a PostScript-equipped typesetting machine (such as the Linotronic 300) for final output. Your proofs just won't be accurate.

LaserWriter output matches Linotronic output because both Apple and Linotype Corporation use Adobe's PostScript fonts. On Bitstream's behalf, director of sales and marketing Bill Andrews says the 35 outline fonts that Bitstream provides to PostScript clone makers match the character widths of Adobe's 35 built-in LaserWriter Plus fonts. Compugraphic has made a similar announcement.

What to Look For in a Clone

Clone makers, printer manufacturers, type vendors—everyone agrees that testing is the way to stay out of the incompatibility trap. No one agrees, however, on who should do the testing and what kind of testing is necessary. According to Michael Weiss of Infonetics in Santa Clara, California, which offers a testing service to clone makers, every PostScript clone must be tested to ensure that it works properly with every PostScript application on the market.

Testing application programs is especially vital to Mac users, who have a better-defined standard for PostScript compatibility than do IBM PC users. More than 50 programs with PostScript printing abilities are available on the Mac; only ten or so similar programs currently exist for the IBM PC. Mike Drewry of Control-C Software, however, points out that many applications use less than 25 percent of the available PostScript commands. As a result, tests must be designed to push the clone to its limit with PostScript files that include every PostScript command—the "throw the Red Book at it" approach to testing.

Clone makers as well as printer vendors perform compatibility tests themselves. While you can't simply take their word for their products' compatibility, neither can you test clones with every program on the market before you buy. In addition to Infonetics, there's at least one other company—Desktop Publishing Solutions in Livonia, Michigan—that offers independent PostScript compatibility certification. Frank Lee of Desktop Publishing Solutions says, "A smart user should avoid looking at any printer that hasn't been independently tested. There will be cases of developers trying to achieve better performance by not doing complete PostScript implementations." You can bet, though, that no printer vendor will advertise a failing grade if its clone is proven incompatible by an independent testing company.

If you're thinking about buying a PostScript clone, first you have to be ready to wait for it. The first clones for the Mac probably won't ship until the end of this year at the earliest. And, if you think clone makers will be able to deliver on their promises of lower price tags compared with PostScript printers, you've got another think coming. When the clones do arrive, for however much money, check their claims of compatibility as well. Ask for specific qualifications of phrases like "95 percent compatible"—what does it mean to be 5 percent incompatible? Examine the print quality of graphic special effects and—more important—type in both small (about 6 points) and large sizes (60 points and bigger). Compare the proofs you get from the clone with final output from a typesetter, if you plan to use the clone as a proofing device. Make sure you can share the clone over an AppleTalk network. And test it with all your application programs. Then consider the usual printer features such as paper handling and ease of installation.

PostScript clones are definitely for the very adventurous and the very patient. Until some standard test of PostScript compatibility is decided upon, it's going to be difficult to identify a successful clone and ascertain its true value. □

See *Where to Buy* for contact information.

Reviews

Heavy-Duty Word Processor

***WordPerfect** 1.0*

Word processor. ***Pros:*** *Tremendous depth and breadth of features; includes macro language, newspaper- or screenplay-style columns; sophisticated editing, formatting, and file management; automatic save, automatic hyphenation, spelling checker, thesaurus, outliner; facilities for endnotes, footnotes, table of contents, and index; elaborate online help; exhaustive manual; toll-free technical support.* ***Cons:*** *Still contains some bugs, especially with screen refresh and word wrap; some formatting limitations when importing or exporting WordPerfect files from or to WordPerfect running on different computers; some unnecessary variations from the Mac interface.* ***Company:*** *WordPerfect.* ***List price:*** *$395.* ***Requires:*** *512K, two 800K drives; hard disk recommended.*



WordPerfect, one of the premier word processors in the MS-DOS world, brings to the Mac power features that are oriented toward the office user. Although those not in the business mainstream will find the product a bit too impersonal, WordPerfect offers more breadth and depth of features than any other word processor on the Mac, and in spite of its MS-DOS heritage, it is distinctly Mac-like. For those writers who need a program as powerful as this, there's no substitute.

More than a Look-Alike

Initially, WordPerfect seems a lot like MacWrite. For instance, WordPerfect offers only one more choice, Windows, on the main menu bar. But when you start to explore, you'll find that WordPerfect has 154 menu choices (including 18 hierarchical menus) and 67 ⌘-key options. (For those with extended keyboards, there are also 60 F-key combinations.) MacWrite, on the other hand, offers only 46 menu choices and 20 ⌘-key options. This is a crude way to compare packages, but you get the idea.

WordPerfect's and MacWrite's start-up screens look similar, except for the bottom of the window. MacWrite makes this area part of the writing surface; most other word processors display the page number in the lower left-hand corner and provide a horizontal scroll bar. WordPerfect displays not only the page number, but the line number as well. Although this feature may seem unimportant—especially when you consider that your per-page line count can vary drastically depending on the font you use—users whose work requires a line count will find it a lot more efficient than doing a manual count. Moving the cursor over the page number changes the arrow to the word *GO.* Enter any number, and the cursor jumps to that page.

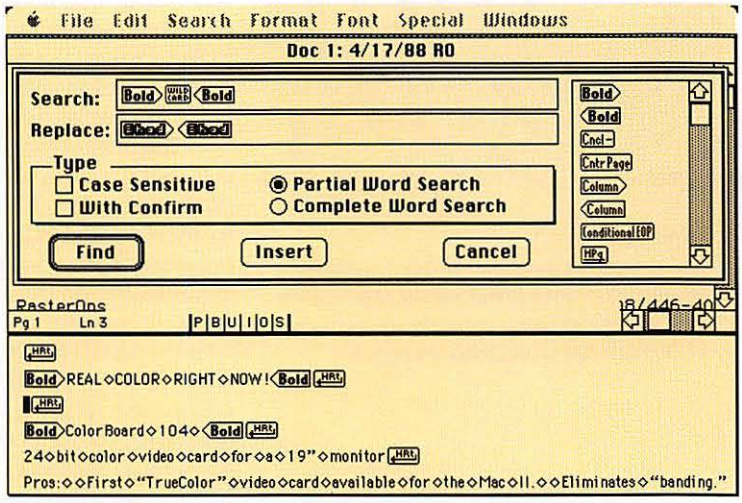
Just to the right of the line number is the most un-Mac-like feature in the program: a row of six small buttons for changing style (for instance, boldface or italic). Clicking one of these buttons changes the style of selected text, or lets you begin typing in a new style. (Alternately, you can change style with a ⌘-key combination or via a hierarchical menu.) Next to the buttons is a large space that displays messages that indicate when the program is automatically saving a file or when text is selected, for example.

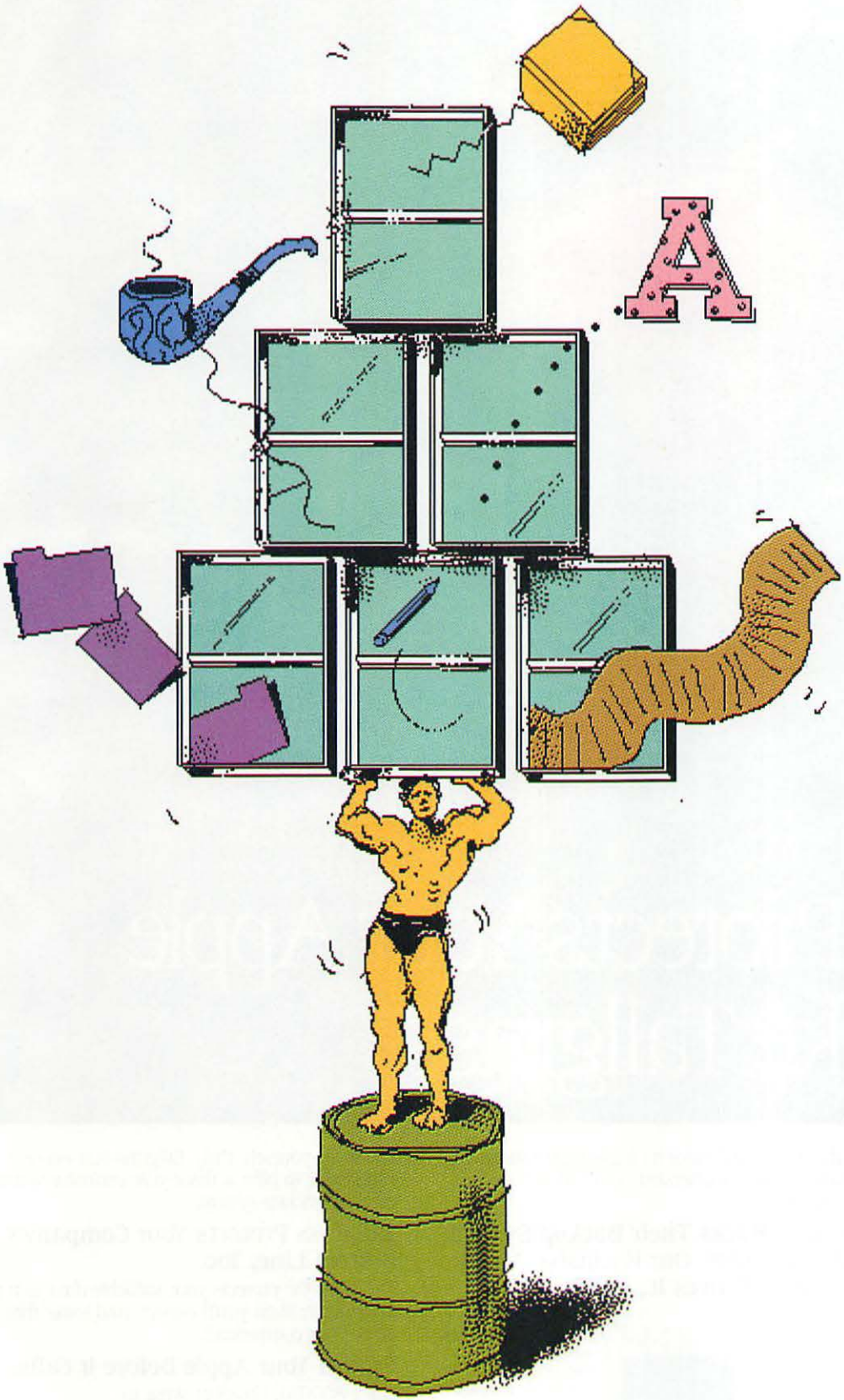
Features Galore

If I did nothing but list WordPerfect's features, I would still exceed the space *Macworld* has allotted this review. But to mention some of the most important ones: you can open as many windows as your machine's memory allows; you can use big screens, small screens, or a combination of the two; and you can see your documents in color. The ruler can be up to 22 inches wide. WordPerfect's macro language handles very sophisticated operations like mail merge, or trivial tasks like reassigning ⌘-key combinations. Making style sheets or customized stationery are excellent ways to use the macro language. Those ten-

Snazzy Searches

In addition to the standard Search and Replace options, WordPerfect offers a scrollable list of formatting codes that you can search for, replace, or insert. Note the Wild Card option. In the bottom half of this split screen, the user has opted to display formatting codes. You can delete, copy, cut, or paste any of them.





tative about writing macros can have the program record a series of mouse and keyboard actions. The File Management feature gives you a level of control found only in utilities such as Disk Tools II. For instance, you can open, print, copy, rename, and delete files, select Get Info for a file, create a new folder, or do a word search.

A real lifesaver, the Auto Save option smoothly and unobtrusively backs up the active file as often as you like—so if the system crashes, your work is safe. You can, however, still close a file without permanently saving any changes made during the work session.

For precision editing, you can make the normally invisible formatting codes visible. The window splits, with the top appearing as normal and the bottom containing WordPerfect's proprietary formatting icons. The icons can be cut, copied, and pasted. The Search and Change window includes a scrollable list of WordPerfect's hundred or so symbols, making global replacement a snap. In addition to the standard Undo feature, the program offers an Undelete command that recovers three levels of deleted material. You can append to, rather than replace, the Clipboard's contents.

WordPerfect is the first Macintosh word processor to include both newspaper-style and screenplay-style columns. In newspaper-style columns, text flows from the bottom of one column to the top of the next column on the same page. With screenplay-style columns, text flows from the bottom of one column to the top of a column in the same position on the next page—a very handy feature when creating tables. Each page can have up to 24 columns of various widths, and you can use different column styles on the same page.

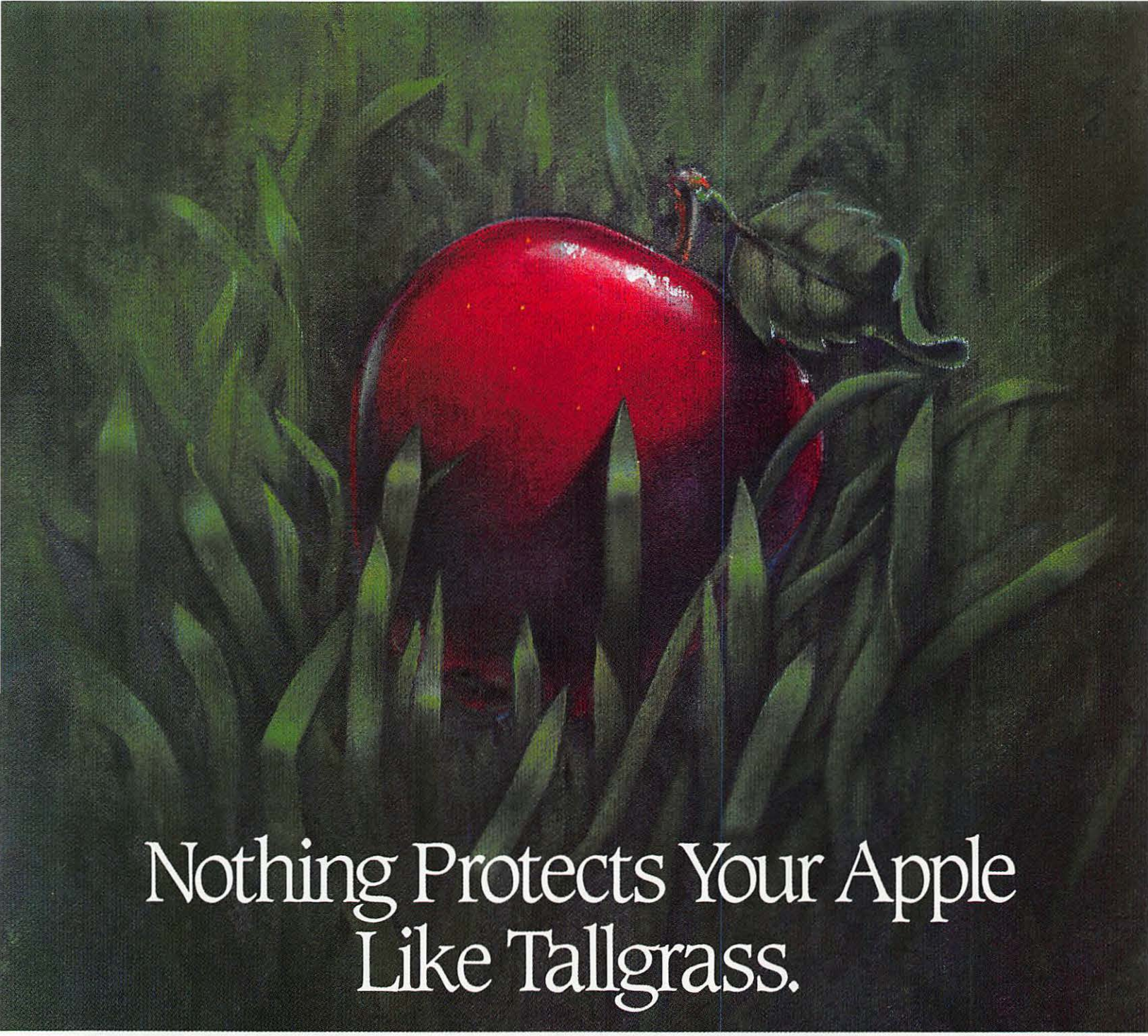
Other features include an outliner, merge, endnotes, footnotes, and the ability to embed PostScript commands in any document. The spelling checker is excellent, with a dictionary fattened to 115,000 words, including several thousand legal and medical terms. Less-important features that are among my favorites include word count, fixed or variable date stamp, dot leader tabs (for example, 229 . . . . . 327), and vertical page centering.

Performance

Although not totally bug free, WordPerfect version 1.0 is many times cleaner than Word 3.0 was when it was released. WordPerfect's screen refresh is still slow,

(continues)

ILLUSTRATIONS BY MARK ULRICH



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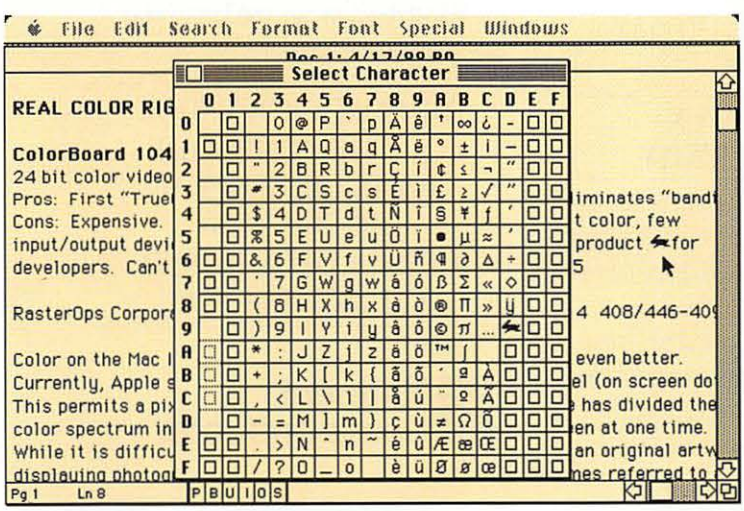
For all the effort put into loading WordPerfect with features, the developers seem to have lost sight of the really important points. The program is disturbingly slow when reformatting, say, a paragraph in which I've just deleted some text. The word wrap can't keep up with my typing (40 to 50 words per minute), sometimes getting so far behind that a line becomes temporarily garbled. And, for all the program's claims of flexibility, the interface is awkward for those who prefer using the mouse for most operations. Nearly 70 percent of the commands must be accessed through sub-menus, including those for such commonly used features as line spacing (the ruler lacks an icon for specifying single or double spacing). In addition, to get a true Macintosh feel, the style buttons at the bottom of the screen should be customizable and the window that displays formatting codes should be resizable. I'd really like to find a substitute for Microsoft Word, but WordPerfect's major performance and interface problems rule it out as a candidate.
—Cheryl Spencer

and characters sometimes disappear mysteriously at the end of lines in certain word wrap situations, only to reappear miraculously if you change the wrap. Others with different work habits from mine will undoubtedly uncover additional problems.

From PC to Mac

Ideally, WordPerfect would allow users to transfer word processing files transparently between all brands of computers that run the program. Just how much users are going to be disappointed by this implied promise remains to be seen. WordPerfect has stated that it will not currently attempt to transfer all the Mac formatting—such as font size, types, and styles—to the PC version. It will very likely be easier to retain formatting when transferring files among various Mac word processors than when passing Mac WordPerfect files to WordPerfect on the IBM PC or other computers. Currently, the manual recommends that before opening a WordPerfect file from another computer, the user should change the file's Creator and Type. People whose regular work routine includes such file transfers aren't going to like this.

The manual is a three-ring binder holding nearly 700 pages. In general, it is well organized and well written. Technical support is toll free and the support technicians are affable and knowledgeable. Ask others who use WordPerfect—the company has a long-standing reputation for quality service.



Searching for Something Strange
Ever forgotten how to find a foreign or strange character? The Insert Literal menu choice shows you the complete character set currently in use. Just click on the desired character. WordPerfect inserts it at the cursor, and the Insert Literal window disappears.

A Power User Purchase

This is not the ideal word processor for everyone—many users have little need for the high-end features or the high-end price tag. Others will want a different set of features, such as those found in page-layout programs. WordPerfect allows you to import graphics, resize and move them, but it does not offer drawing tools, nor does it even allow you to draw boxes around blocks of text. But, although this product won't allow everyone to pass files back and forth transparently in an office with more than one brand of computer, WordPerfect is already my word processor of choice for the business environment.
—Scott Beamer

See *Where to Buy* for contact information.

Apple's PostScript Pair

LaserWriter IINT

PostScript laser printer. ***Pros:*** *Faster, smaller, and less expensive than previous LaserWriters; darker blacks; newer PostScript version allows more downloadable fonts.* ***Cons:*** *No memory-expansion options; awkward DIP switches for changing operation mode; performance remains average.* ***Company:*** *Apple Computer.* ***List price:*** *$4599.*

LaserWriter IINTX

PostScript laser printer. ***Pros:*** *Fast, 68020-based controller; expandable to 12MB RAM; accepts SCSI drive for font storage; emulates Hewlett-Packard LaserJet Plus.* ***Cons:*** *Performance hampered by relatively slow Canon SX engine; doesn't work with some storage devices; no parallel port for PC connection; awkward DIP switches for changing operation mode.* ***Company:*** *Apple Computer.* ***List price:*** *$6599.*

With its LaserWriter family, Apple introduced the world to the quality of PostScript printing. But Apple's pioneering printers were quickly upstaged by faster, often less-expensive printers. The LaserWriter IINT and IINTX update Apple's PostScript printer line and share several commendable traits.

Both printers run version 47 of PostScript, which is faster and uses memory

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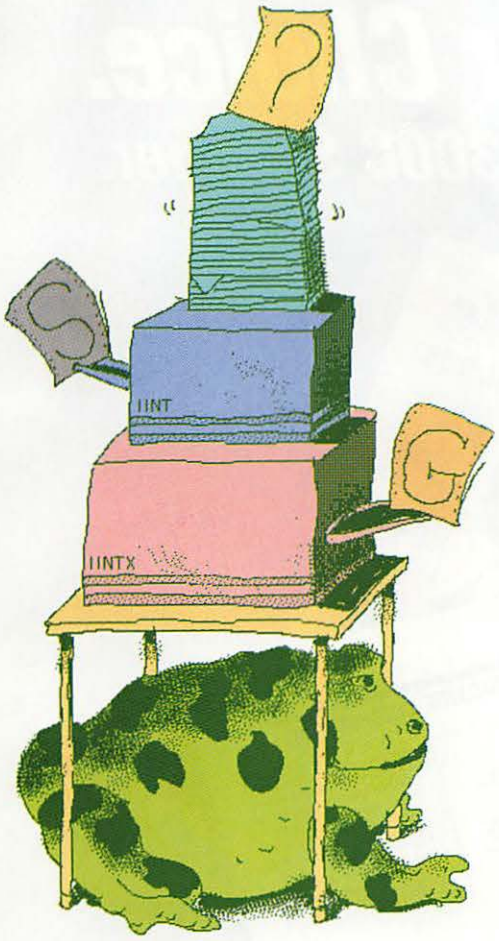
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more efficiently than its predecessors. Both use Canon's new SX print engine, which replaces the CX engine used in earlier LaserWriters. The SX engine feeds paper more reliably and prints darker images, although some people—myself included—prefer the CX engine for its superior rendering of fine details. Unlike other PostScript printers, both the IINT and IINTX contain smoothing routines that can be used to soften the edges of bitmapped graphics and text. (For background on the LaserWriter II family, see "The LaserWriter Lines Up," *Macworld,* March 1988).

Both printers also offer various upgrade and expansion options. For an additional $2499, an NT becomes a top-of-the-line NTX. (That's $499 more than you'll pay for an NTX to begin with, however.) The NTX accepts a variety of memory and hard disk expansion options.

Running on NT

The IINT replaces the LaserWriter Plus as Apple's PostScript printer for the masses (at least the masses who can spend over four grand for a printer). Like the Plus, the NT includes 35 fonts. The NT, however, contains 2 megabytes of RAM, versus the Plus's 1.5MB. That, combined with the memory-efficient PostScript version 47, means the NT can hold many more downloadable fonts than the Plus. I successfully shoehorned 14 fonts into the NT's memory; the Plus usually chokes after 4.

Many of the NT's competitors, however—including QMS's PS 810, AST's TurboLaser/PS, and NEC's SilentWriter LC-890—offer 3MB of RAM, and thus can hold dozens of fonts. Unfortunately, the NT's memory isn't expandable. If you use downloadable fonts by the dozen, consider those other printers first.

The NT retains the LaserWriter Plus's ports and operating modes. There's an AppleTalk port and a 25-pin serial port for use with IBM PCs and other computers lacking AppleTalk interfaces, and there's a Diablo 630 emulation mode. On earlier LaserWriters, you switched between modes using a clearly labeled rotary switch. On the NT, you must wrestle with two tiny DIP switches located next to the printer's serial port—after you've checked the manual to find the right settings. Unlabeled DIP switches aren't what I expect from a company whose claim to fame is simplicity. On the test track, the NT performed well, but far from best (see "PostScript Performance").

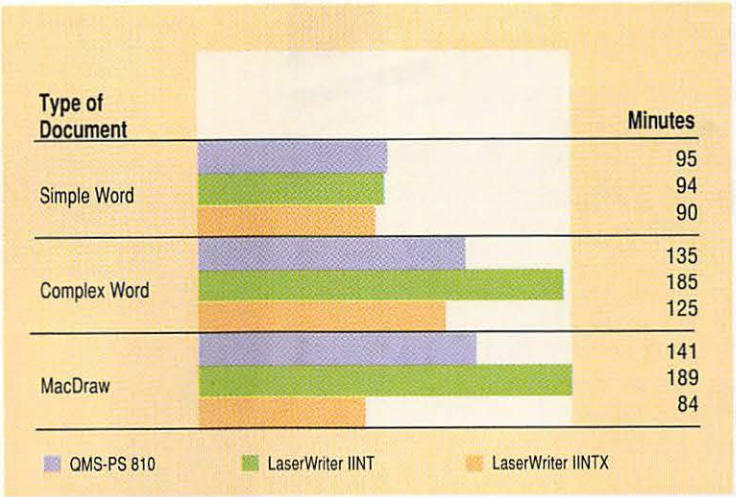
These criticisms might lead you to believe that NT stands for "nice try." I wouldn't go that far. The NT is a good performer, and its price is among the lowest in its class. The NT simply lacks features that many of its competitors provide, including a Hewlett-Packard LaserJet Plus emulation mode and a parallel port for fast communication with IBM PCs. If you plan to use a printer with PCs as well as Macs, you'd be better off with the QMS-PS 810. In addition to working better with PCs, the PS 810 is faster. At $5495, however, the PS 810 lists for $896 more than the NT.

More Power to You

The LaserWriter IINTX is the Mac II of Apple's PostScript printer line: a high-performance model designed for demanding applications. Like the Mac II, the NTX is driven by a 68020 microprocessor running at 16MHz (the 68000 in the NT runs at only 12MHz). Also like the Mac II, the NTX is expandable. You can increase its RAM to a whopping 12MB, and there's space to plug in optional font-expansion boards. (No boards had been announced at this writing.)

The NTX's biggest asset is its ability to use a SCSI storage device for holding downloadable fonts and as an extension of the printer's font cache—both performance-boosting features. But you can't use just any SCSI drive. Before it can initialize the drive, the NTX software must determine the drive's capacity. Most Mac hard disks can provide this information via a SCSI routine, but some disk makers haven't implemented that routine. At this writing, Apple was preparing a list of drives that do and don't work with the NTX.

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Performance
The LaserWriter IINT performed well against QMS's PS 810 and the high-end IINTX on a simple text document but stumbled when printing complex material. On complex documents, the NTX outpaces all competition—adding memory and a hard disk would make it even faster. Tests were run on a 2MB Mac II with a hard disk.

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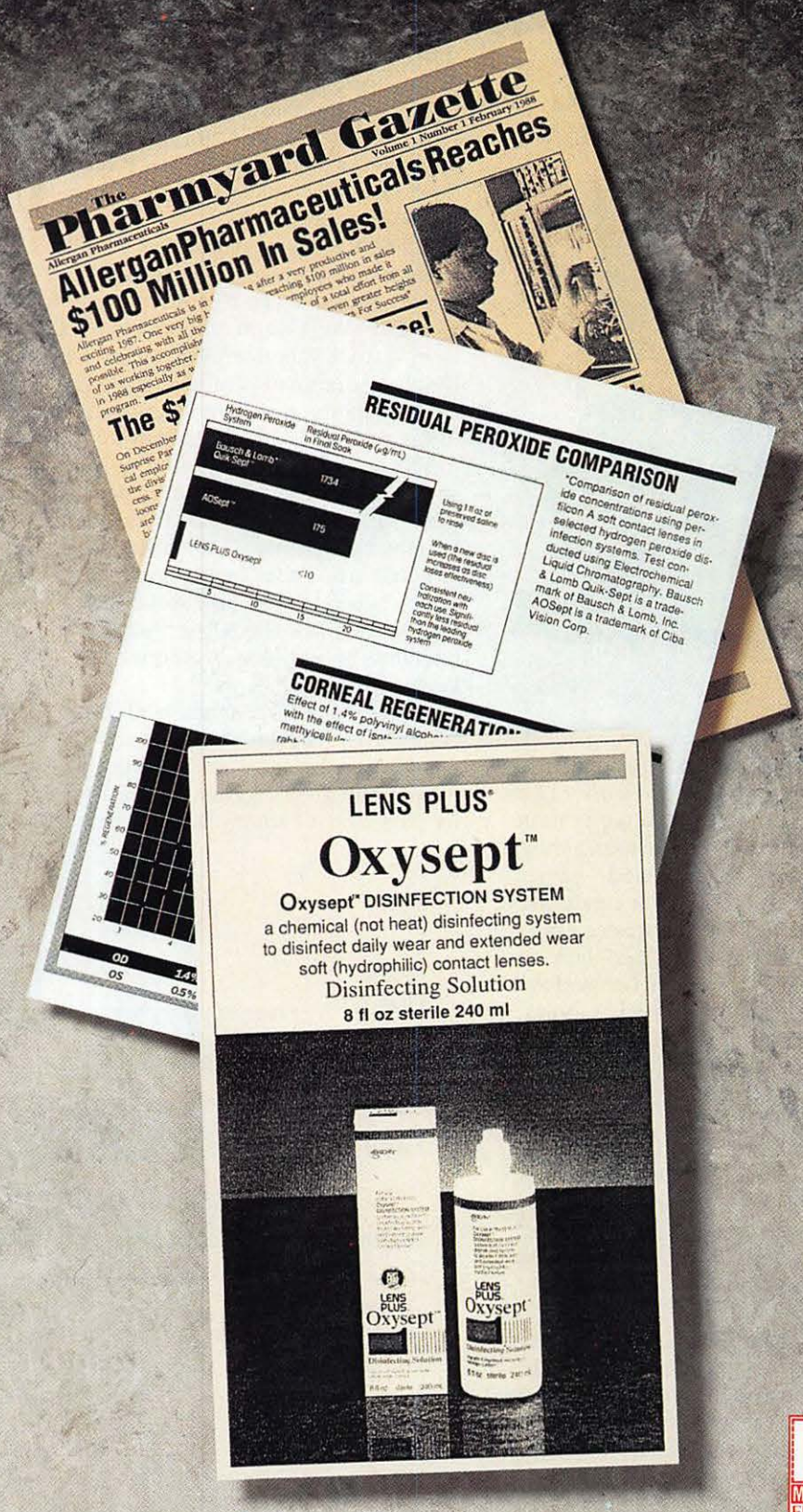


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The NTX also emulates an HP LaserJet Plus, although it lacks the parallel port so common in the PC world. And my complaints about unlabeled DIP switches apply here, too. The NTX has not two, but six of the beasts, making mode switching that much more complicated.

But it's hard to argue with the NTX's performance. This Porsche of a printer turned in faster times than any PostScript printer I've used, especially when printing complex graphics documents. A 20MB SCSI hard disk boosted performance further.

In most PostScript printers, the engine often waits for the controller. That isn't always the case with the NTX, which can print many documents at its engine's rated speed of eight pages per minute. QMS and Dataproducts have announced NTX competitors that combine similar controllers with faster engines. Users in the market for a high-performance, high-volume PostScript printer should also consider QMS's PS 1500 and Dataproducts' LZR-1260.

The LaserWriter IINT and IINTX are solid, reliable performers, and they're competitively priced. But the NT's mix of performance and features is uninspiring, and the NTX may be outdone by other offerings. In the game of PostScript printer leapfrog, Apple has yet to regain its lead.
—Jim Heid

See *Where to Buy* for contact information.

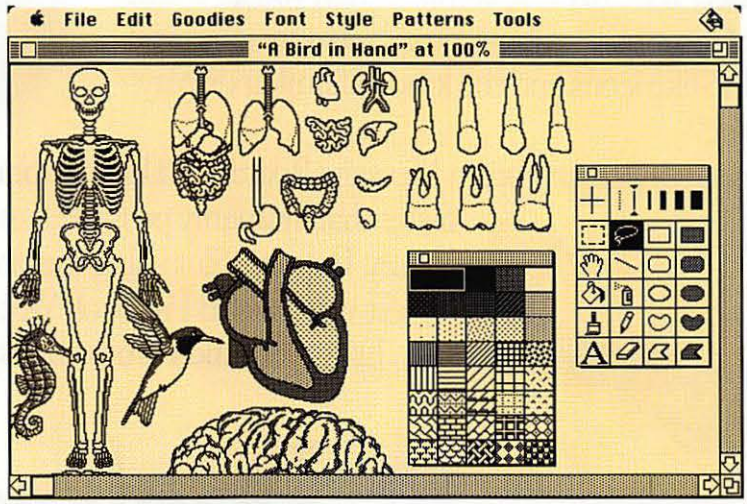
A Few Strokes Short

***MacPaint** 2.0*

Paint software. ***Pros:*** *Easy to learn and use; Snapshot feature encourages experimentation; autoscrolling; multiple windows and magnification levels; full use of tools in 50 percent view.* ***Cons:*** *No object-oriented drawing layer; poor value compared with some competitors; no 300-dpi editing.* ***Company:*** *Claris.* ***List price:*** *$125.* ***Requires:*** *512KE.*

Sometimes you fall so far behind in a race that it's hard to catch up. This appears to be the case with the latest version of MacPaint. MacPaint 2.0 falls short of its competitors because it does not let you create object-oriented graphics or text—you can't edit shapes as shapes and you can't work with text as in a word processor. Furthermore, you can't take advantage of a laser printer's ability to produce higher-resolution text and graphics.

MacPaint's lack of object-oriented drawing features, however, makes the program easy to learn and use. Some people are confused by graphics programs that mix objects with bitmaps; they try to edit the bitmapped portions of the document with object-drawing tools and vice versa—which, of course, they can't do.



Tear-Offs
MacPaint keeps drawing tools and patterns in tear-off *menus, which you can drag onto the desktop. Here's a tip: By pressing* t *for tools or* p *for patterns you can hide or show the appropriate menu at the cursor position.*

Snapshots and a Magic Eraser

MacPaint's best new feature, the Snapshot, leaves you free to experiment and make mistakes. Taking a snapshot saves the current image in memory (not on disk). You can continue drawing, adding as many modifications as you like. Later, if you decide you don't like the changes you can revert to the original image.

More significant is the ability to restore sections of the document selectively. Using the selection tools with the Revert To Snapshot command lets you reinstate only the selected area. You can also use the Magic Eraser, which erases only those changes made since the last snapshot.

Measuring Strokes

Compared just on the basis of its paint features, MacPaint is roughly equal to its competition. With the exception of the Snapshot and Magic Eraser features, most of MacPaint's redesign merely serves to make current a program badly out of date. As offered, MacPaint reminds me most of FullPaint, a program introduced two years ago that was quickly discarded by most people in favor of SuperPaint.

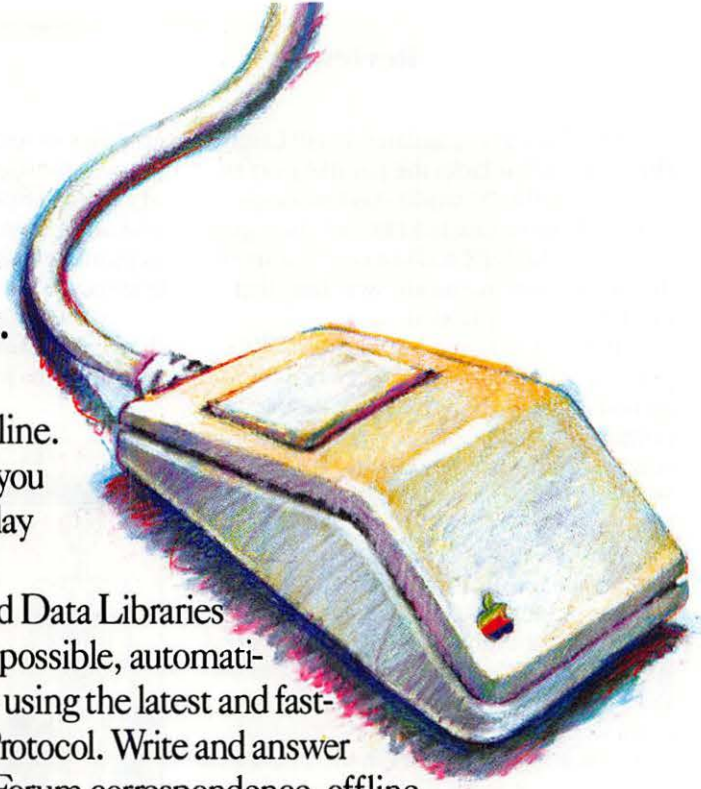
Screen layout features, including windowing, scrolling, and magnifications, provide MacPaint's major improvements. First of all, if you have a big enough screen you can see the entire 8-by-10-inch drawing area. You can also open up to nine documents at once, depending on available memory. Moving around a document has been improved by the addition of scroll bars and automatic scrolling.

The terms FatBits and Show Page have been retired for a better (if less colorful) world of four magnification levels—of 50, 200, 400, and 800 percent. You can use all tools in all four magnification levels. I especially appreciated the ability to work at the 50 percent magnification. But, unlike most of its competition, MacPaint cannot edit pictures at 300 dots per inch—a useful feature for refining graphic details such as logos.

Much is made of one new feature called tear-off menus. The tools and pattern palettes have been reconstituted as broad, squat menus that you can drag onto the desktop. At first glance this seems to be the best of both worlds. But in practice, you almost never select tools from the menu, an operation that requires extra dexterity and mouse movement. Once on

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Command.

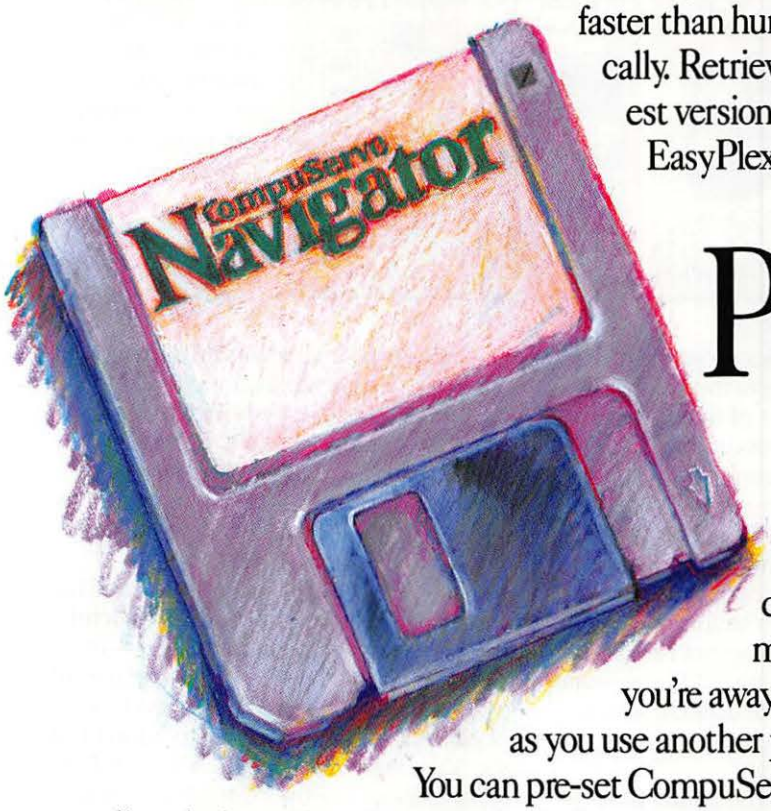


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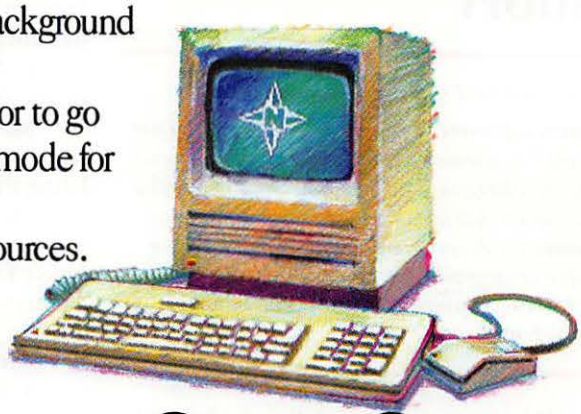
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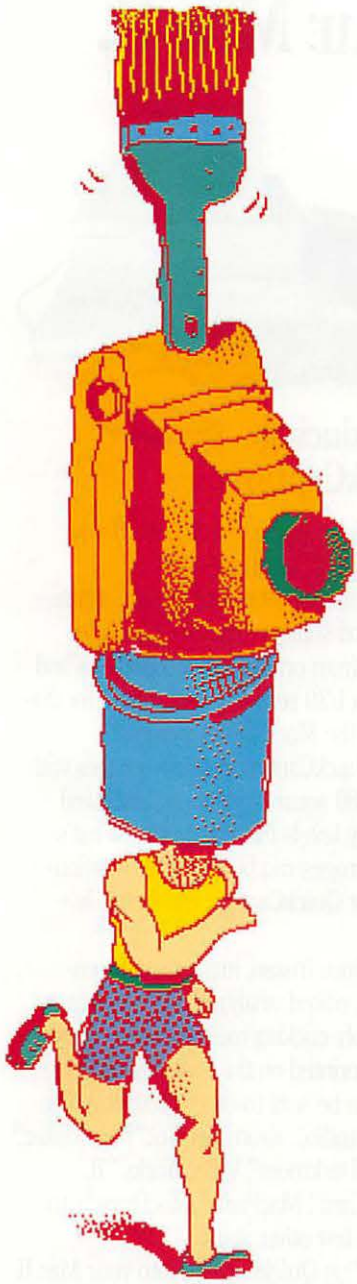
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the desktop, the broad shape of the palettes is more difficult to work around than narrow columns. Worst of all, the tear-off menus make the program less accessible to beginners—MacPaint's chief virtue.

Finishing Touches

A few other additions worth mentioning are an adjustable grid, scalable selections, transparent patterns, templates, shapes drawn from their centers, and mouse position readouts. Although MacPaint still lacks an adjustable airbrush and such common effects as distort, skew, perspective, and 1-degree rotations, these are not really serious omissions.

MacPaint's problem is that it is a few strokes short on value. You can get both object-oriented drawing and bitmapped graphics for the same price by purchasing one of the program's competitors. Due largely to the Snapshot feature and MacPaint's appealing simplicity, the program has a place among users who find object-oriented graphics confusing and plan only to use an ImageWriter. Overall, however, as MacPaint approaches the finish line it is still playing catch-up. —*Adrian Mello*

See *Where to Buy* for contact information.

Is It a Printer or Is It a File?

AnyText *1.12*
AnyGraph *1.11*

PC printer capture program for text and graphics with translators for use with Apple File Exchange. ***Pros:*** *Print-capture feature makes it easy to use with many PC programs.* ***Cons:*** *No file-transfer features; limited to MacWrite and MacPaint formats; graphics files use large amounts of disk space on the PC; AnyPC with AnyGraph is slow.* ***Company:*** *Compatible Systems Corporation.* ***List price:*** *$95 each (includes AnyPC).* ***Requires:*** *Mac Plus.*



With more and more Macs and IBM PCs and compatibles rubbing shoulders in offices, transferring information between the two types of machines has become all the more important. AnyText and AnyGraph are packages that attempt to translate PC output files into Mac-format files but fail to cover all the bases.

My Printer, Your File

AnyText and AnyGraph are translator files that work with the Apple File Exchange (AFE) program that comes with Apple's System Software Update 5.0. Included with both packages is a program called AnyPC, which runs on any PC and redirects printer output to a PC file for subsequent transfer to the Mac, where it can be translated.

AnyPC intercepts all output directed to the IBM Graphics Printer or equivalent; when activated, AnyPC pops up on the PC screen and provides options for saving the output to a file or continuing as a normal print job. To use the output on a Mac, you save the output in a PC file, transfer that file to the Mac, and use AFE with either AnyText or AnyGraph to convert the file into a usable format. Neither AnyText nor AnyGraph provides the means for transferring files between a PC and a Mac, so you'll have to use another utility, such as QuickShare, TOPS, AppleShare PC, or the DaynaFile.

AnyPC translates word processing files fairly quickly on the PC because it has to deal with characters and text styles only (see "A Test of Time"). On the other hand, AnyPC captures graphics output much more slowly because it has to resolve the printed page in a line-by-line, or *raster,* mode. Files saved by AnyPC for conversion to Mac files with AnyGraph take up a lot of disk space. A simple 5K Lotus .PIC file became a 250K file when I captured it using AnyPC. In fact, the first time I tried saving the file, I ran out of disk space, but the program saved the incomplete file nonetheless. Since AnyPC behaves like a dot matrix printer, saving the image line by line, the program simply closed the file when it ran out of disk space. (AnyGraph had no problem translating the truncated file into a MacPaint file.) The size of the final complete MacPaint file was only 12K.

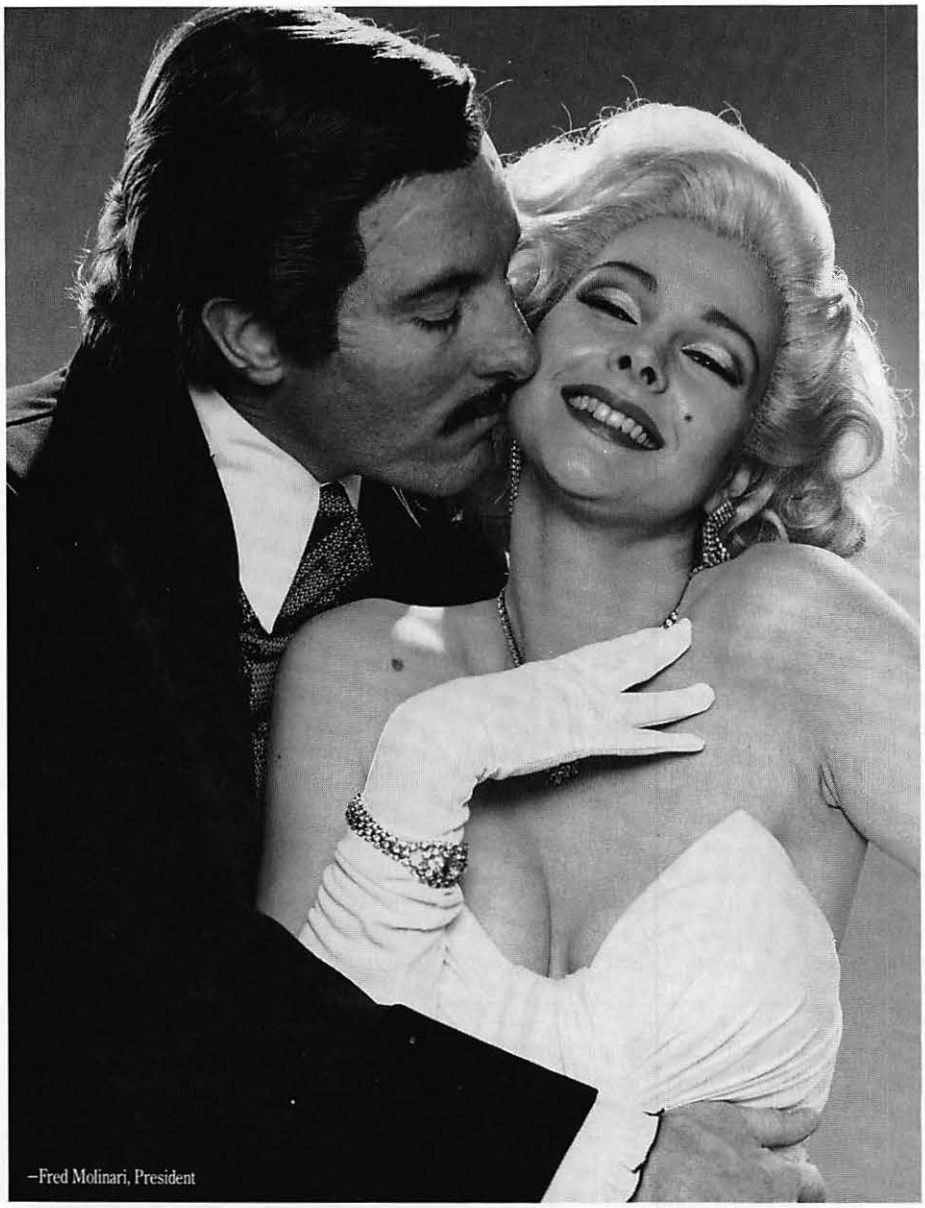
On the Mac side, you need to know how to use the AFE, which is described in the Macintosh Utilities User's Guide. AFE is simple to use, partly because of its similarity to Apple's Font/DA Mover. The only added step is selecting the AnyText or AnyGraph file for use as a translator. Then you select the files to be translated and AFE does the rest.

Lowest Common Denominators

As translators of PC output, AnyText and AnyGraph are fairly versatile despite their apparent simplicity. By emulating a rather common dot matrix printer, AnyPC allows you to create files using any PC-based word processor. However, the resulting MacWrite file may not resemble the original PC word processor file exactly. AnyText preserves bold and italic styles as well as superscripts and subscripts, but doesn't always handle all of the tabs in a ta-

(continues)

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A Test of Time

Original File Size	Time to Create	AnyPC File Size
WordStar		
5600 bytes	17 secs.	6192 bytes
11,200 bytes	25 secs.	12,281 bytes
22,400 bytes	45 secs.	24,455 bytes
Lotus 1-2-3 .PIC file		
5000 bytes	1 min. 55 secs.	200,200 bytes
6000 bytes	2 min. 10 secs.	253,000 bytes

A Test of Time
These timing tests for AnyPC's capture of output from WordStar (for text files) and Lotus 1-2-3's PrintGraph facility (for graphics) were run on a Tandy PC/XT clone.

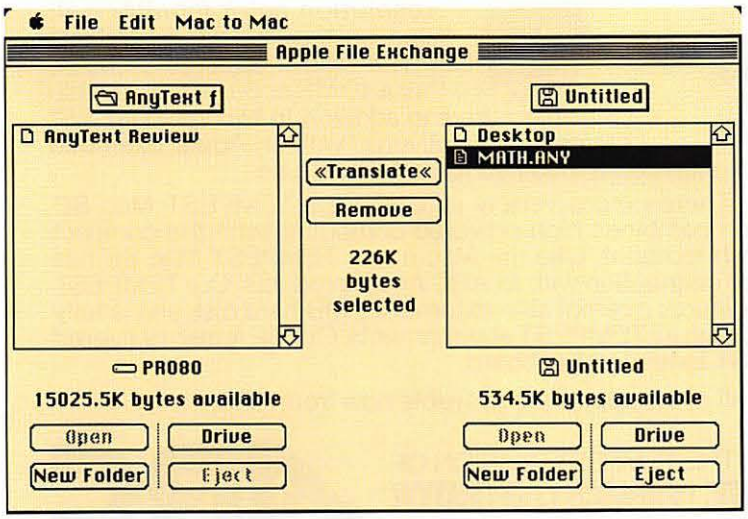
ble. Sometimes it readjusts to fit MacWrite's default 6-inch column, which may change the length of a document. AnyText uses a statistical method to determine what the tabs are and fails to recognize tabs in a table shorter than three lines.

Using AnyPC to capture graphical output from a PC reveals more limitations. Although the IBM Graphics Printer handles resolutions of 60, 120, and 240 dots per inch (dpi), Compatible Systems recommends using the lowest printer resolution so that the translated file in MacPaint format (80 dpi) will more closely resemble the original. As the company admits, the IBM Graphics Printer was chosen as the lowest common denominator, which means that many of the PC's more powerful graphics programs and spreadsheets are severely restricted by what they can portray when directed to AnyPC. For example, there's no way to save the color attributes of a PC screen. If you're looking to transfer EGA-format (Enhanced Graphics Adapter) screen shots in color or gray levels to the Mac, you're better off using PC programs like HotShot and HiJaak to save the screens and convert them to encapsulated PostScript or PICT files.

Too Little for Too Much

Considering that AnyPC forms a common link between AnyText and AnyGraph, I feel that the two translators should be bundled together as one package, rather than sold separately. Especially since AnyText and AnyGraph do not include file-transfer facilities (Compatible Systems would probably like to see you buy its QuickShare product), $190 is a little steep for the privilege of translating both text and graphics files. The combination of AnyText, AnyGraph, and AnyPC performs exactly the same functions as QSPC and PC Transfer, which are part of QuickShare. If your office already has networked Macs and PCs, AnyText is useful for translating word processor files and tables, but if you're planning on moving beyond low-resolution MacPaint graphics, you'd be better served by other PC-based screen-capture programs.—*Dave Kosiur*

See *Where to Buy* for contact information.



Making the Move
Once the AnyText and AnyGraph translators are installed in Apple File Exchange, you select files (MATH.ANY was created by AnyPC from a Lotus 1-2-3 graph) for translation into MacWrite, for AnyText, or MacPaint, for AnyGraph.

Everything but the Kitchen

***McSink** 4.4*

Text-editing and file-management desk accessory. ***Pros:*** *A wide variety of options augment application operations.* ***Cons:*** *Garbage appears at ends of lines after some operations; capricious system crashes.* ***Company:*** *Signature Software (also available on most online services).* ***List price:*** *Version 4.5 $25* ***Requires:*** *512KE; System 4.1; 128K ROM.*



Do your favorite applications allow you to check the number of characters, words, or paragraphs in any given text selection? Can you sort; add line numbers; columnize data; or choose to see tab, space, and carriage returns as symbols? Delete files without leaving an open document? Display and edit file info such as Type and Creator codes? McSink, a very ambitious shareware desk accessory, purports to do all this and more. And with bug fixes and enhancements spawning new versions almost monthly, McSink comes close to matching expectations with performance.

Initially, McSink sported a single window and a hodgepodge menu. Now, the program handles up to 16 concurrent windows and offers nearly 50 text-editing and file-management options. To edit text, however, you must first bring it into the McSink window by copying it from the Clipboard. You can also open files saved in text-only format and previously created McSink files.

Once you place text inside a McSink window, you can set parameters for changing the case of letters or words, for indentations, for converting tabs to spaces and back again, for adding line numbers, and for columnizing information. Prefix and suffix strings can be added to selected lines as can line feeds. Trailing white space can be stripped from selected text.

Version 4.4 seems to fix a bug that made McSink crash when writing to any printer besides an ImageWriter. No matter what printer you use (including laser printers), text appears only in draft mode. A handy new option, Statistics, records

(continues)

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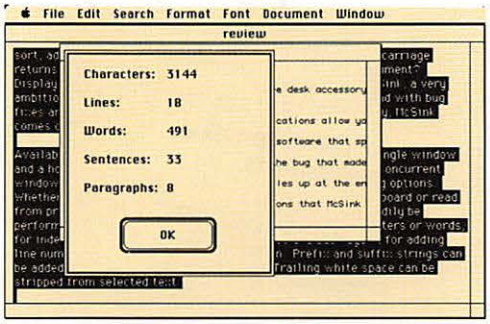
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Handy Stats

McSink's Statistics feature provides information on the number of characters, lines, words, sentences, and paragraphs in this selection from a Word document. Because McSink doesn't always count carriage returns, however, the paragraph stat is unreliable. The McSink window can be seen behind the statistics, and the Word document behind that.

how many characters, words, lines, sentences, and paragraphs occur within a selection; but because it doesn't always count carriage returns as the start of a new paragraph, paragraph data can be unreliable. Change and Change All options have been added to the Find feature. Switching from "Word wrap to length" (you set line length in a dialog box) to "Word wrap to window" (text wraps to whatever size you make the window) now takes much less time. And in a bug fix, McSink no longer crashes when quitting MacWrite with more than one McSink window open.

There are still glitches. Garbage piles up at the ends of lines after some operations, such as changing tabs. System crashes occur occasionally when opening and closing windows. Using the Columnize options requires careful planning so that rows don't end up as columns and data doesn't become indecipherably misaligned. And the McSink menu disappears when using the Find option.

Still, given the sheer number of options that McSink handles successfully, this shareware seems well worth the price of registration. (Users who download it and report undiscovered bugs are registered for free.) And, as all-encompassing as this DA has proven to be, maybe future versions will even throw in the kitchen sink. —*Suzanne Stefanac*

See *Where to Buy* for contact information.

Upgrading to SCSI

***HD-20 WSI** 1.1*

Hard disk upgrade. ***Pros:*** *Substantially improves performance of an Apple Hard Disk 20; easy installation.* ***Cons:*** *Can't format for best performance on Mac SE or Mac II.* ***Company:*** *Personal Computer Peripherals Corporation.* ***List price:*** *$295.* ***Requires:*** *Hard Disk 20; SCSI port.*



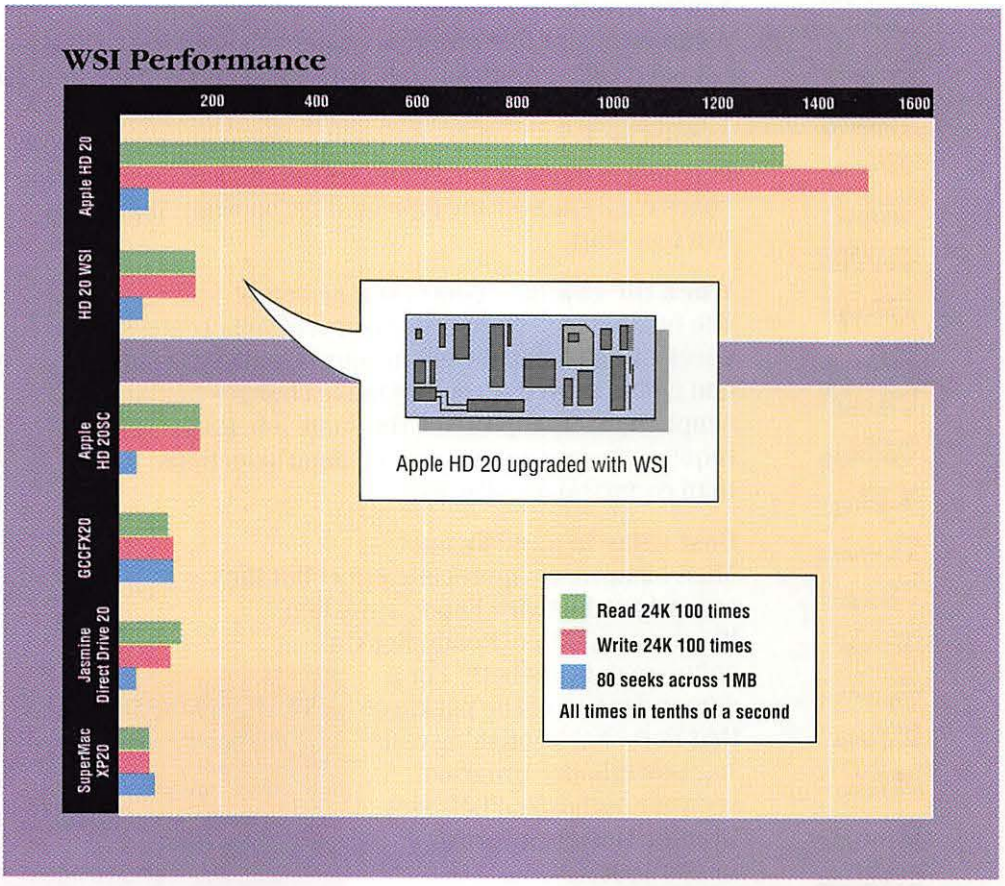
You don't know how slow a hard disk drive can be unless you've used an Apple Hard Disk 20 connected to the Mac disk port. Nevertheless, Apple sold thousands of Hard Disk 20 drives because they're solidly built, reliable, reasonably quiet, and for a while were as fast as anything except expensive, exotic, temperamental, internal hard disk drives. A WSI (With SCSI Interface) upgrade improves a Hard Disk 20's performance by exchanging the disk port interface for the much faster SCSI port interface that's standard on all Macs sold today. (A Mac 512K or 512KE can also be retrofitted with a SCSI port.)

The WSI upgrade consists of a circuit board and cable assembly that replace the standard board and cable in a Hard Disk 20. In addition, you get a manual with complete installation instructions, a special tool for opening the Hard Disk 20 cabinet, and two floppies containing utility software. The software includes a test and format utility, a file locater, ImageWriter and LaserWriter spoolers, a quick-copier for floppy copying, and a backup/restore application.

Installing the Upgrade

Personal Computers Peripherals Corporation (PCPC) recommends having a technician install the upgrade, but any reasonably handy person can do it in a half-

(continues)



WSI Performance

Apple's Hard Disk 20 (which connects to the Mac's disk port) performs dismally when compared with Apple's Hard Disk 20SC. But adding the HD-20 WSI board gives the HD-20 a SCSI interface and brings its performance in line with today's popular SCSI hard disks. Tests were done using DiskTimer II.

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hour or so using two screwdrivers and the hex wrench that PCPC provides. The installation instructions are detailed, straightforward, and fairly complete. The main danger of installing it yourself is inadvertently zapping the upgrade circuit board with static electricity. Static you can't see or feel can be strong enough to weaken or destroy electronic components.

You must spend 1 to 6 hours before and after installation testing, backing up, formatting, and restoring the Hard Disk 20, depending on how full your drive is and whether you back up to floppies, tape, or another hard disk. The work isn't difficult, although I became a bit confused when formatting the drive, because the formatting program offers several options not explained in the instructions. A tech support person explained why the options were irrelevant and assured me that I could rely on the printed instructions.

Using an HD

After surgery, the Hard Disk 20 looks, sounds, and smells the same. But the tortoise has become a hare. The HD-20 WSI's theoretical performance, as measured by the DiskTimer II tests, is on a par with other 20-megabyte SCSI drives (see "WSI Performance"). Some people criticize these tests as too academic, but the numbers are widely published for many hard disks, and do show some correlation with performance in everyday use. After using an HD-20 WSI for a month, I'd say it performs like an average 20MB hard disk.

The disk space available after formatting is less than the average, however, and also a bit less than before the conversion. Whereas most 20MB hard disks have between 20MB and 21MB, a conventional Hard Disk 20 has just over 19MB and an HD-20 WSI has just under 18MB.

You can chain other SCSI devices to an HD-20 WSI. It has a 25-pin SCSI port where the external floppy port was before the upgrade. Switches inside the drive determine the SCSI priority number. Termination is internal and can be removed by prying out three small electronic parts.

Adequate Software

The bundled software is useful but hardly a compelling reason to buy. The file locater desk accessory and laser printer spooler provide functions and performance similar to Apple's Find File and Print Monitor. PCPC's laser spooler interferes less with foreground work but is more trouble-prone than Apple's. For example, restarting the Mac in the midst of a spooled laser print job can result in a hung Mac. The PCPC ImageWriter spooler has no Apple equivalent, and it works fine.

The included backup application, HFS Backup 2.02, is adequate but not the best available. The software formatter could set up the disk with only a 3-to-1 interleave ratio, making the HD-20 WSI best suited to a Plus. The WSI will work on an SE or Mac II, but won't have the speed of a drive that can be formatted with a 2-to-1 or 1-to-1 interleave ratio.

Don't put your venerable Hard Disk 20 out to pasture because it's too slow. It will deliver contemporary SCSI performance if you install the WSI upgrade. I'd do it if I had a Hard Disk 20. —*Lon Poole*

See *Where to Buy* for contact information.

Math without Tears

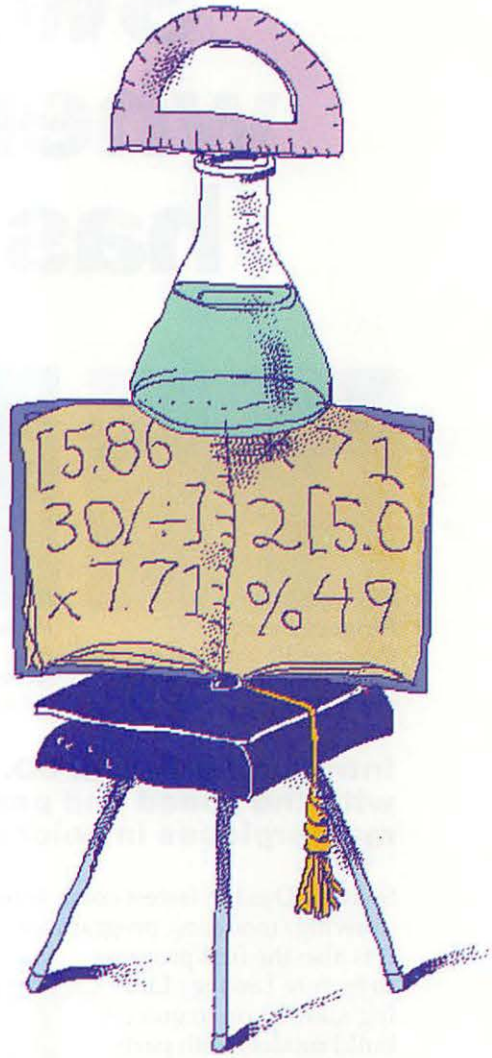
***Calculus** 1.0*

Math tutorial program. ***Pros:*** *Amazingly well-designed interface and demonstrations.* ***Cons:*** *Copy-protected master disk.* ***Company:*** *Sensei Software.* ***List price:*** *$99.95.* ***Requires:*** *512K, 800K total disk space.*



Calculus is a great educational watershed, upon which it is decided who becomes a scientist or engineer and who doesn't. Unfortunately, it's a subject in which students in the United States show the worst test results of any industrial nation.

Sensei has accepted the challenge of producing software that will really help you *learn* Calculus 1A, as well as pass the course. In succeeding beyond anyone's most optimistic expectations, Calculus rates as one of the best pieces of educational software ever produced—superior in some respects even to Sensei's remarkable Physics program. It's also the only program of its kind available on any computer. If you were a college student having trouble with calculus, it would make good economic sense to buy an old 512K Mac just for the purpose of using this program. It's that good.



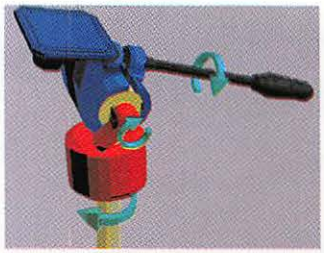
By the Book

The program is keyed to the order of presentation in standard texts, covering limits, derivatives and their applications, integrals and their applications, methods of integration, and a special unit on graphing. The Subject menu lets you jump to any of 11 chapters with a Table of Contents, or to specific topics with an Index. One of my few complaints about the program is that it doesn't reach into vector calculus, but the treatment of calculus basics is so thorough that advanced topics would require another disk. As it stands, the material will take a freshman calculus student from September to April or May.

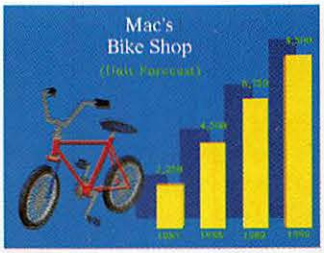
There are three parts to a Calculus chapter. First, the program has short tuto-

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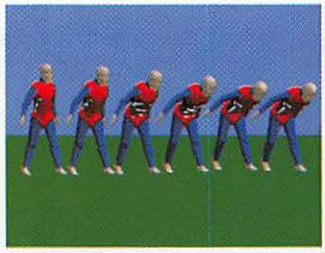
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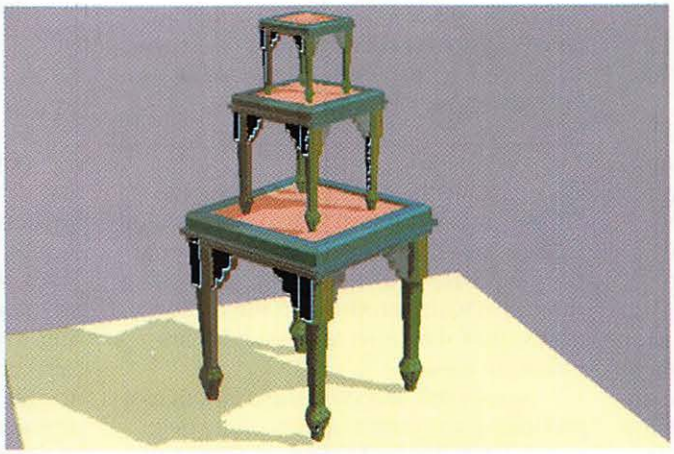
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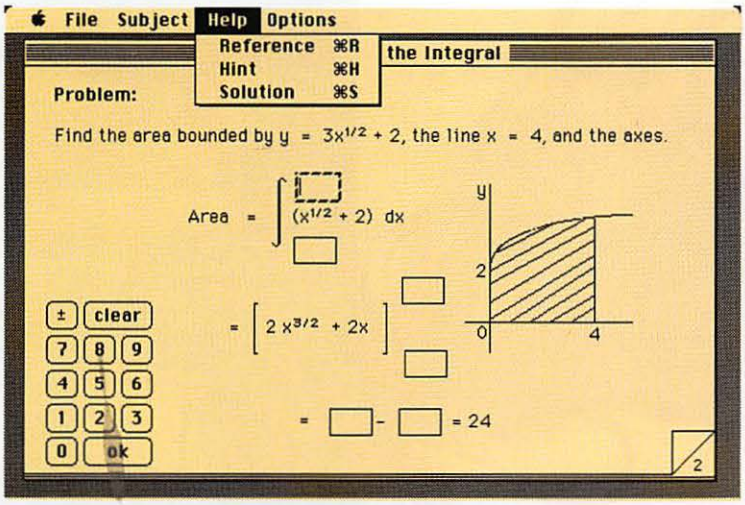
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rial introductions to topics, amplified by hypertext insertions (you can click on italicized terms and More buttons for extra explanation) and animated diagrams of concepts. This means—in contrast to textbook presentations—that you view a continuous flow of the "right" material, matched to your own questions and needs. Pedagogically, this is ideal for maintaining interest and motivation.

Second, each chapter has extensive lists of orthodox problems. For solving these, you can call on Reference, Hint, or Solution from the Calculus Help menu—the Options menu also lets you step through the chapters in Problems Only or Tutorial Only mode.

ln and exp functions) that are properly part of a pre-calculus course. The topics are included here because deficiencies in background are often the most serious obstacles to learning calculus. Likewise, recognizing that many students in college will be taking physics at the same time, there's an emphasis on acceleration/velocity problems as applications.

The problem and demonstration set in methods of integration (a topic on which many students fall apart completely) is not only thorough but sympathetic. It presents a carefully graded sequence that works from absolutely simple cases at the beginning, through small steps, up to challenging exam-level problems.



Integrated Software *This sample problem from Calculus shows the straightforward character of its problem drills—you can find this one in most texts. But the program goes far beyond standard texts in its interactive demonstration of problem-solving methods.*

Finally, there are demonstrations of sample problems. These are step-by-step solutions of fancier textbook material, using animation to particularly good effect in showing computational substitutions and simplifications. The demonstration window includes a Why? button to explain each step in the sequence, and Repeat and Start Again buttons to simulate an infinitely patient instructor. For convenience, the File menu features Save Place and Restore Place items (a sort of bookmark function) and a Print Page option. These are standard in all Sensei applications.

Local Maxima

The people who developed this software clearly understand the realities of calculus teaching. The program, for example, offers lots of drill on topics (trigonometry,

Sensei has also evaluated all the ways a graphics screen can go beyond a blackboard or text illustration, and has made every screen count. Assuming that the student has almost no background in graphing, the program also offers a special section on graphing that amounts to a compelling demonstration of the Mac's powers as an instructional tool.

The Answers

For many students, this program could mean the difference between passing and failing calculus. That's not bad for a hundred bucks. For other Mac owners, it could be an interesting educational bridge that takes them into a deeper comprehension of the world of science. Let's hope Sensei brings out programs on advanced calculus and differential equations as well.

—Charles Seiter

See *Where to Buy* for contact information.

Carats to Cubits

Chameleon *1.0*

Measurement-conversion utility. ***Pros:*** *Encyclopedic range of possible conversions; easy to use.* ***Cons:*** *Application version only; no cut and paste; occasional glitches.* ***Company:*** *Spectrum Computing.* ***List price:*** *$69.95.* ***Requires:*** *512K.*



Hauling out a copy of the *CRC Handbook of Chemistry and Physics* and converting units of measurement is sometimes difficult and confusing. Converting units of power (energy divided by time), for example, often produces Murphy's Law situations in which seconds or feet or pounds or kilograms don't match up properly. If you regularly need to convert picas to inches or carats to grams, you should investigate Chameleon.

Not only does Chameleon automate unit conversions, it also offers a relentlessly thorough list of units. As you would expect, all types of metric-to-English-system conversions are featured, but the scope of the program also covers items like barleycorns, kalpas (an aeon-like Hindu time unit), and barns (a very tiny area unit used in nuclear physics). The program is much more compact (80K) than a comparable reference book would be, and includes more than a million possible conversions.

Dollars to Doughnuts

Chameleon uses a menu bar which, while sufficient unto its purposes, deviates from standard Macintosh practice. Instead of a File menu, there are menus for selecting types of conversion and invoking Chameleon's simple Multiply function. Basic Units includes distance, mass, time, and temperature; Derived Units includes energy, pressure, force, and illumination; and Other Units includes area, volume, speed, density, power, flow rate, inertia (area), and inertia (volume). The documentation is minimal, but it's no problem running Chameleon without help, anyway.

After selecting a type of conversion, you pick a unit from the scrolling list on the left, and one from the list on the right;

(continues)

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The Big Picture CX showing color CAD drawing



The Big Picture with Double Feature softwar displaying word processing and spreadsheet.



The Big Picture C20 displaying a color scan photograph.



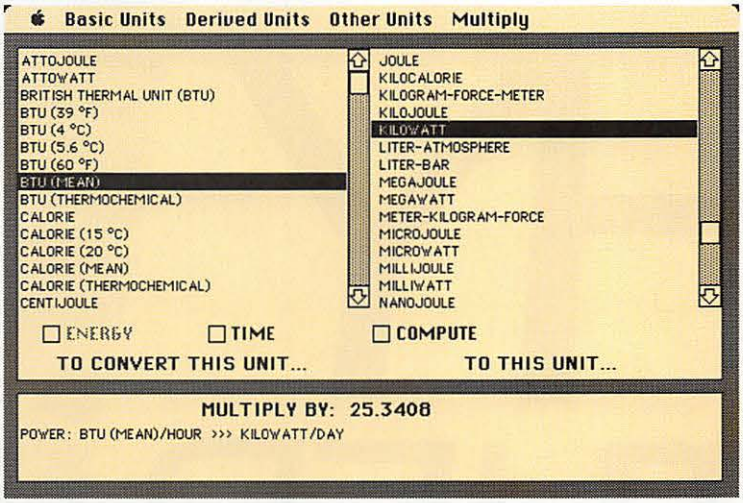
The Big Picture for the Macintosh II showing Excel™ spreadsheet.



DoubleColor card showing full page presenta running on NEC Multisync™ Plus.



The Big Picture IQ™ photographic image qua grey scale monitor.



Quick-Change Artist

To convert power units (energy divided by time) Chameleon lets you toggle between an energy unit screen and a time unit screen, combining the two with the Compute check box. Here a conversion from BTU per hour to kilowatts per day has been determined.

Chameleon gives you the conversion factor (see "Quick-Change Artist"). Chameleon is especially convenient for conversions involving derived units; the program forces you to do the conversion correctly (it's always clear what you're converting from, and what you're converting to). To be blunt, you will get the right answer using Chameleon, even if you're not very good at this sort of thing and have only a hazy understanding of dimensional analysis.

Does Not Compute (Partly)

Chameleon is afflicted with a small number of programming infelicities. If you invoke a DA, such as Calculator, you will find a DA-sized hole in the screen when you close the DA. The screen can usually be restored by clicking in Chameleon's scroll bars, but it's an annoying defect, occasionally hanging the program altogether. Also, since the program doesn't offer the standard File and Edit menus, there's no way to cut and paste conversion factors to another program. Instead, you must write down the numbers and rekey them in the other application.

Although Chameleon does run under MultiFinder, nearly everyone who sees it asks, "Why isn't this a DA?" Indeed, a smaller version of the program, with many historical or otherwise curious units omitted, would make a spectacular 25K science/engineering DA. Spectrum Computing, however, defends its approach, saying that its intention is to provide an automated, foolproof replacement for a reference book—one that the user will consult relatively infrequently, but one that will also be well worth the price when the need arises.

Does It Add Up?

Spectrum's claim is valid. The program will pay for itself in a great variety of professional applications, despite its lack of such conveniences as direct export of conversion factors. Perhaps Spectrum will eventually supply the program as both application and DA. In the meanwhile, it's a competent utility tailored to its own niche market.—*Charles Seiter*

See *Where to Buy* for contact information.

More than an Upgrade

***MacProject II** 1.0*

Project planning software. ***Pros:*** *Quick learning curve; enables you to monitor and plan projects; allows a lot of "what if" operations.* ***Cons:*** *Uses nonstandard PERT chart; doesn't link resources and tasks closely enough.* ***Company:*** *Claris.* ***List price:*** *$495.* ***Requires:*** *512KE.*



Like an automatic transmission, MacProject II provides a way for novices to quickly get up to speed in a complex discipline, but it does so at the expense of some control and fine-tuning ability. Although people with no project-management experience will be pleasantly surprised at how quickly they can lay out and monitor projects, others may be frustrated by the program's nonstandard PERT chart and the undisciplined method of creating a plan.

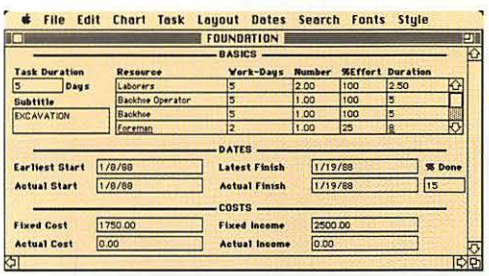
A Quick Study

MacProject II's quick learning curve comes partly from the direct method with which you create the Schedule chart, usually called a PERT (program evaluation review technique) chart. Tasks are represented by boxes that you create as you would in MacDraw. Dependencies between tasks (when one task cannot begin until a previous one has been concluded) are represented by lines connecting the two boxes. You can join tasks as you go, or you can create all the boxes and arrange and connect them later.

Although this is an easy way to create charts, it is not the way most professional project managers work. Normally, you plan tasks and dependencies using an outlining program or paper and pencil. Then you enter them into the project management software, which creates a PERT chart automatically. Also, standard PERT charts look nothing like MacProject II's Schedule chart. In PERT charts, lines represent tasks, and numbered circles (or other shapes) represent the beginning and end of the task. (In MacProject II, shapes represent tasks.) MacProject II also indicates critical path tasks—those which cannot be delayed without delaying the entire project—by displaying them in bold wherever they occur in the chart. Standard project managers string critical path tasks out along a straight line at the top of the chart.

Project-management practices and standards are not whimsy but have been

(continues)



Task Info

You specify resource statistics in the Task Info window. Then the program calculates how long the task will take and displays the result in the Latest Finish box. Here the person planning the project expected the task to take only 5 days. But MacProject II calculated that given the needed resources, it would take 8 working days. The Actual and the % Done boxes allow you to monitor the project.

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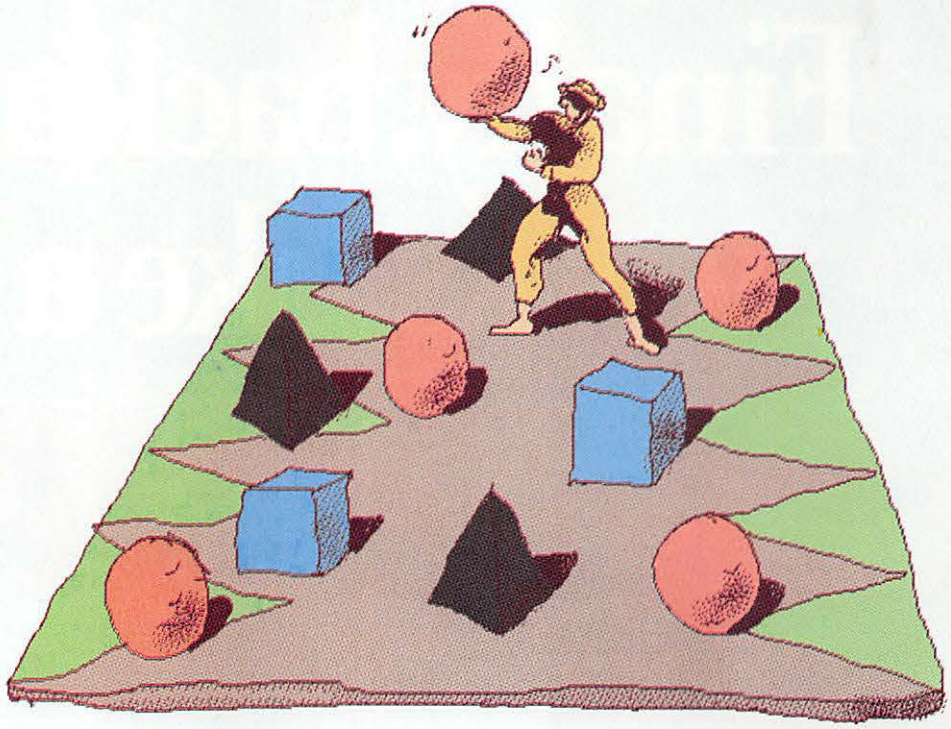
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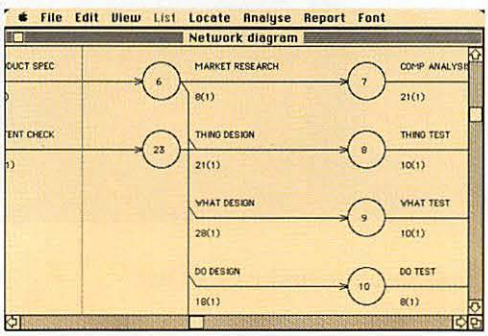
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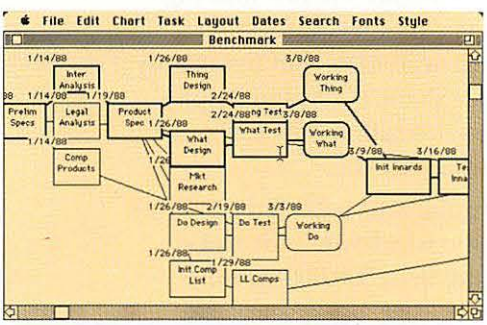
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developed over the last 30 years as the clearest and most effective way to create, depict, and monitor a plan. So while learning how to create a chart is simple with MacProject II, actually creating a legible one that represents a large and complex project is difficult. Even after rearranging things a good deal, you may end up with a tangle of boxes and lines that's hard to follow. But the standard approach demands not only more training for using software, but also a higher level of sophistication with project management in general, since a great deal of planning takes place before you begin to use any program.

The problem of chart legibility occurs only with the Schedule chart—MacProject II creates all other charts automatically. The Task Timeline represents tasks as horizontal bars along a time line. It depicts any slack time—for example, when you expect a task to take one week, but you have two weeks to complete it—as a gray appendage to the task bar. The Resource Timeline depicts resources such as tools or employees in a similar way, allowing you to see clearly if a backhoe is scheduled to be used in two places at once. The Resource Histogram is a bar chart showing the planned level of activity of a single resource. It will warn you if, for example, the backhoe is assigned an impossible 150 percent usage on December 3.







Professional Method vs. Easy Method
MacProject II doesn't use a standard PERT chart, so complex projects can be difficult to display legibly. This is an example of a MacProject II schedule chart (top) and the same project on Micro Planner Plus, which uses standard charts.

One serious criticism leveled at the original MacProject was that it did not allow you to monitor ongoing projects. In MacProject II, you can enter the Actual Start and/or Finish dates for each task. MacProject II recalculates all other dates to show new Actual Start and Finish dates. You can also enter what percentage of each task has been completed. The Task Timeline depicts the completed portion as a black bar beneath the task bar.

Project-planning software should enable you to experiment with rearranging tasks and resources to see how changes affect the project. MacProject II allows a wide range of these "what-if" operations. For example, to change two sequential tasks into parallel ones, simply clear the dependency line between them and reconnect the second task to the same box that the first task is attached to. You can also delay the start date of a task by dragging its bar in the Task Timeline. Or, if resources are overused, you can change the calendar to include Saturday work or extend the workday.

The ability to complete a project on time depends heavily on resources. MacProject II computes the relationship between resources and completion dates, but the program doesn't go far enough. Say you have a single task scheduled to take 5 days, but it requires 80 hours of work from a key employee who has only 8 hours a day to spend on the task. The program automatically reports that the task will take 10 days, and changes the Actual Start and Finish dates of all activities to reflect the delay. If an employee is scheduled to work on two parallel tasks for 40 hours each, the program shows the conflict on the Resource Timeline and Histogram, but it does not reschedule the project. This means you must add resources or go through the tedious process of rescheduling all tasks.

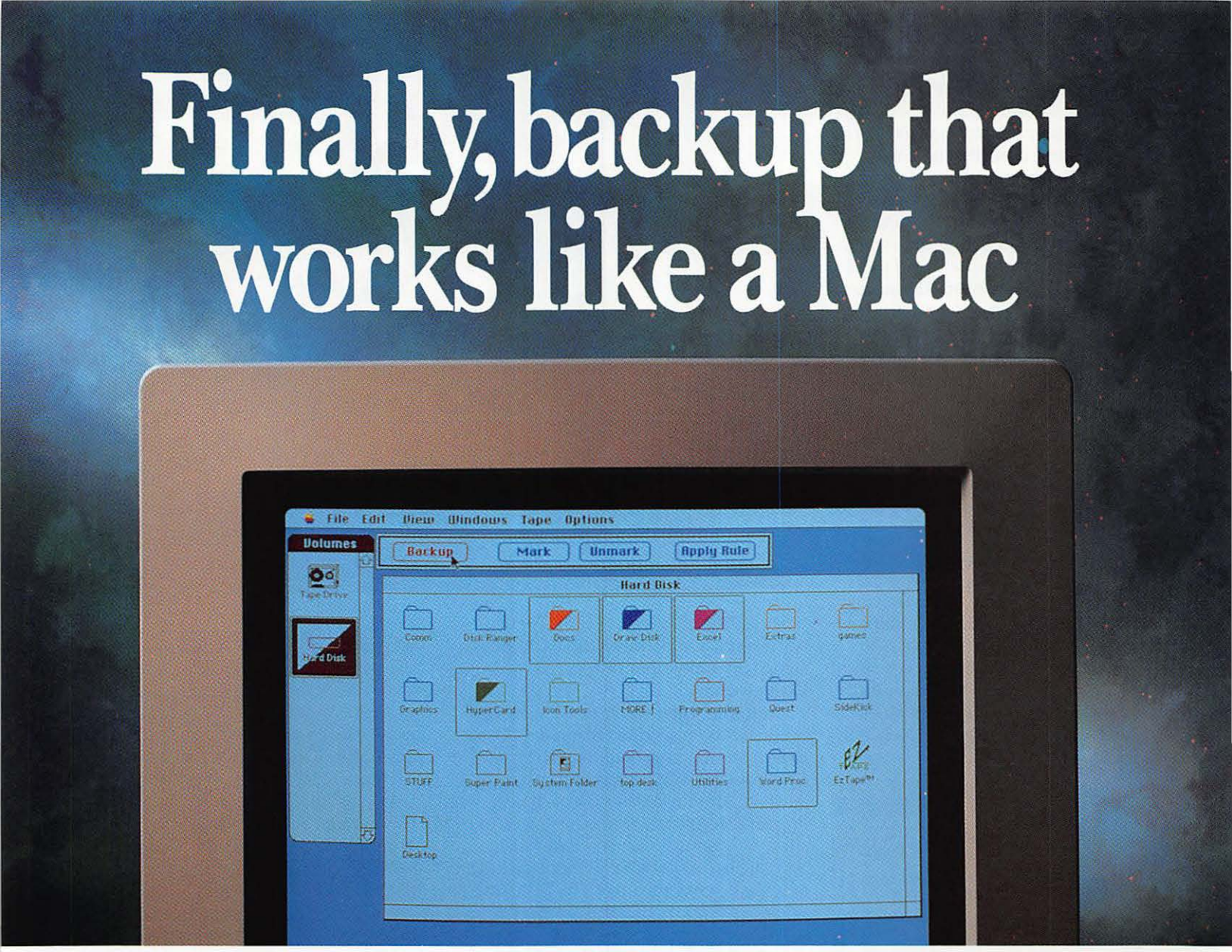
MacProject II versus the Rest

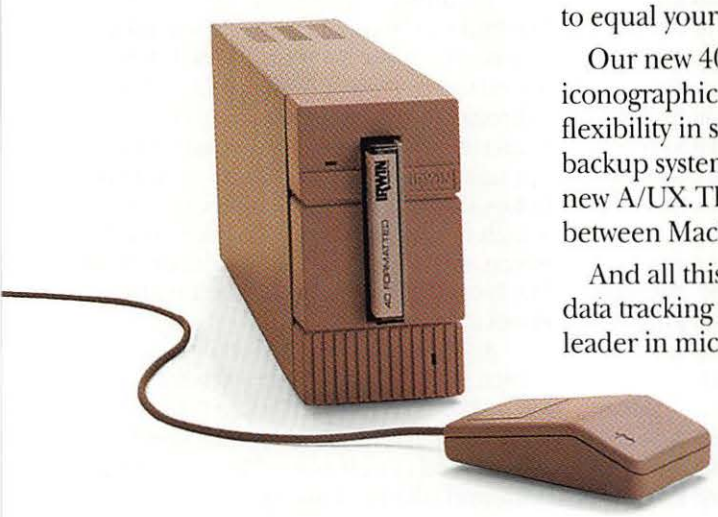
To call MacProject II an upgrade of MacProject is to do its many new features an injustice. Here's a short list of things added to MacProject II: the ability to link subprojects, the ability to calculate resource duration using percentage of effort, optional display of 16 attributes around task boxes, eight different calendars, extensive search modes, and more keyboard entry items. Still, people who have already used MacProject should be able to learn MacProject II very quickly.

At present a Mac user's only other choice in project-planning software is Micro Planner Plus from Micro Planning International. This product uses standard formats and closely resembles mainframe, mini, and IBM PC–based project-planning

(continues)

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software. The primary market for Micro Planner Plus has been professional project managers. Because of its nonstandard PERT chart, MacProject II will have difficulty making inroads in that area. If you intend to work with professional project managers who are accustomed to standard methods, and you are considering MacProject II, you'll have to decide if you can live with being a square peg in a round world.

But there are many more projects that need managing than there are professional project managers. More than a few executives find themselves knee deep and sinking fast in a quagmire of a project that has grown out of control. MacProject II can be a ready tree limb that executives use to pull themselves out of the mess and quickly get on top of things.—*Lawrence Stevens*

See *Where to Buy* for contact information.

Miles and Miles of Art

***ArtRoom** 1.0*

Clip art and fonts on compact disk. ***Pros:*** *Large quantity of artwork that doesn't take up space on a hard disk.* ***Cons:*** *User can't add keywords; libraries should be better organized to facilitate fast searches.* ***Company:*** *Image Club Graphics.* ***List price:*** *$999. (For information on package deals, call Image Club Graphics.)* ***Requires:*** *Mac with SCSI port; CD ROM drive.*

***Kwickee Inhouse Graphic Services' Art Department** 1st and 2nd quarters, 1988*

Advertising-oriented clip art on compact disk. ***Pros:*** *Large quantity of artwork that doesn't take up space on a hard disk.* ***Cons:*** *User can't add keywords; search technique finds unwanted illustrations because of embedded character strings.* ***Company:*** *Multi-Ad Services.* ***List price:*** *$195 per month.* ***Requires:*** *Mac with SCSI port; CD ROM drive.*

According to an insert in Image Club Graphics' latest catalog, a CD ROM disk stores data on a spiral track 3 miles long. A single compact disk can store the equivalent of almost 700 double-sided floppy disks. The mind boggles! But lest you become overwhelmed by sheer quantity, take a minute before buying a CD full of graphics to consider other important factors: quality, ease of access, and whether the artwork is appropriate for your needs. I looked at two CD collections of clip art—Image Club's ArtRoom and Multi-Ad Services' Art Department, a component of their Kwickee Inhouse Graphic Services—and I'm not convinced that CDs are state-of-the-art when it comes to canned art.

What You Get

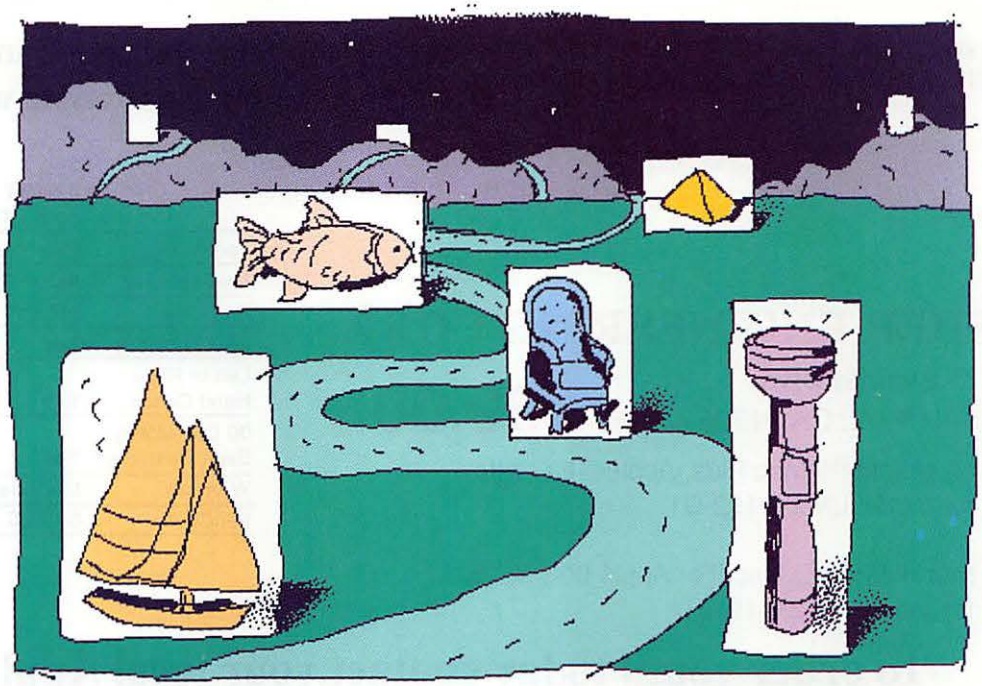
Let's discuss content first. Image Club's ArtRoom disk contains approximately 1000 images created with Illustrator, MacDraw, and Cricket Draw, and saved in PICT or EPS (encapsulated PostScript) format. The disk also includes 50 PageMaker and ReadySetGo page templates and 100 decorative PostScript fonts. The images fall into standard clip art categories such as business, entertainment, travel, maps, sports, people, food, machines, and dingbats. You can paste a drawing into its parent program for editing, or place the drawing directly into a page-layout program.

The images on the ArtRoom disk vary in style and quality. While many are finely crafted, others are simpler and could be drawn by anyone who is reasonably proficient with a graphics program. On the whole, however, I found Image Club's artwork skillfully executed. My main objection is that most of ArtRoom's people and animals are drawn in a cartoon style that, frankly, doesn't appeal to me. But judge for yourself: "ArtRoom Sampler" displays several ArtRoom illustrations.

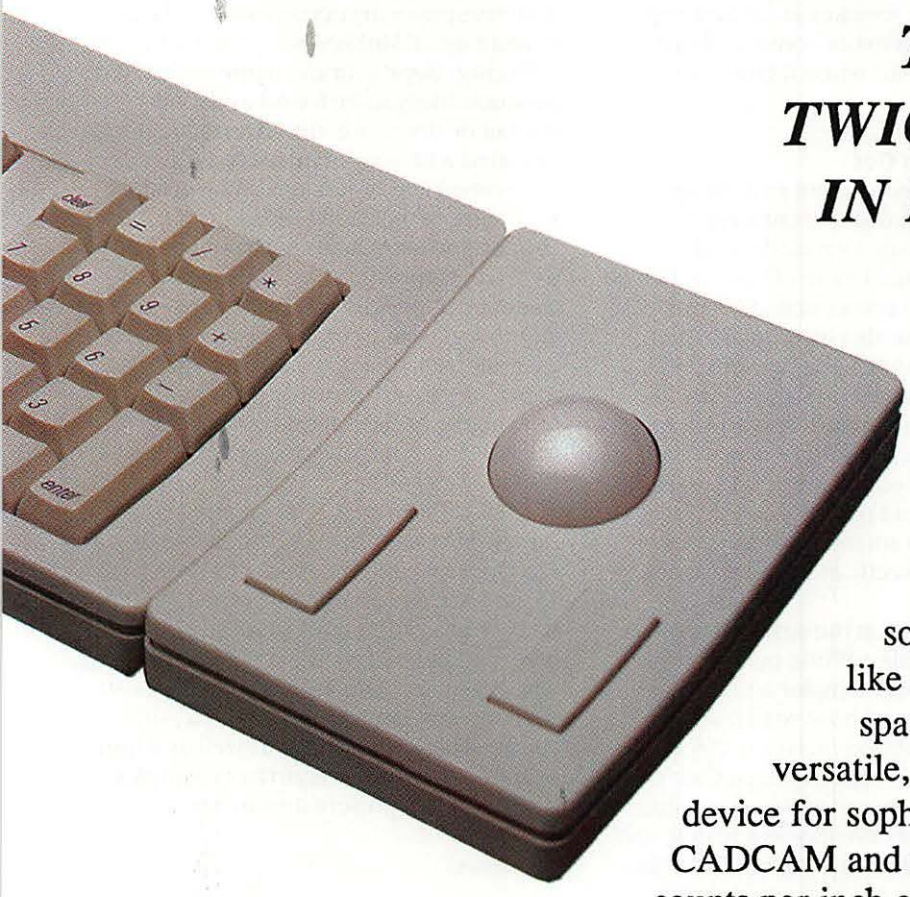
While Image Club's graphics seem to be aimed at individuals, office art departments, or newsletter publishers, Multi-Ad's artwork is intended mainly for retailers and newspaper art departments. A large percentage of Multi-Ad's Art Department collection depicts brand-name and generic products likely to be found in a supermarket or drugstore; the advertising insert included with your Sunday paper may contain some Multi-Ad images. Subject areas for the more than 1000 Illustrator images include sports, leisure, performing arts, foods, consumer goods, maps, fashion, classified ad headings, and months (holiday and seasonal images are provided for each month). Illustrator is the only format these images are available in. Multi-Ad offers quarterly disks at this time; a $149 generic disk for nonadvertising applications is in the works.

As with Image Club's collection, Multi-Ad's images vary in style. The disk is divided into two folders, Product Art and Theme Art. Most of the food and product images are competently rendered but fairly prosaic—but that's what you'd expect from advertising art. The Theme Art images—fashion, seasons, travel, and so on—include realistic renderings as well as whimsical cartoons. "Art Department Sampler" shows some representative images.

(continues)



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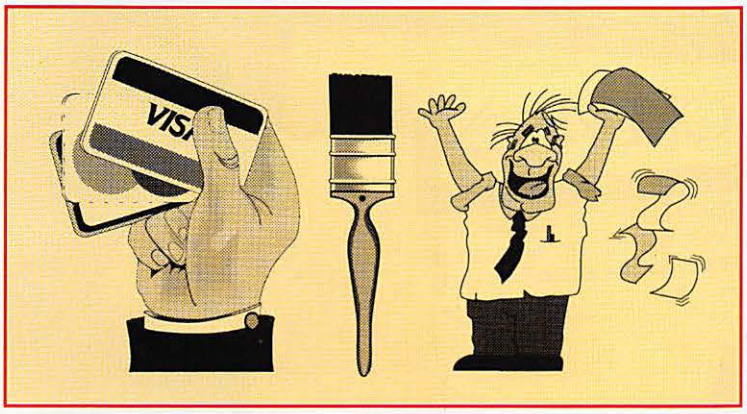
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ArtRoom Sampler
Shown here are representative images from Image Club's CD-based clip art collection.

Getting the Picture

Assuming one of the CD collections meets your needs, the next order of business is retrieving images. Both manufacturers provide their collections in PictureBase (a popular art cataloging and retrieval program), in addition to the original file formats.

The PictureBase Retriever desk accessory comes with both packages. It allows you to view each picture in a library, search a particular library, or search the entire disk to find the image you need. Image Club's disk allows you to place images displayed by the Retriever into PageMaker, ReadySetGo, XPress, and Scoop. Unfortunately, at this time Multi-Ad's illustrations can be placed only into InHouse Layout Department, a customized version of XPress distributed by Multi-Ad Services. (Check with Multi-Ad Services if you wish to use another layout program; a future release should be compatible with several.)

So far the procedure for retrieving graphics seems simple: you're working in a page-layout program and need a certain image; you select the PictureBase Retriever DA, search for the illustration by title or keyword, and place the picture in your document. Unfortunately, once you start looking for images you'll quickly realize that you're stuck with the organizational techniques of the disk's manufacturer. Users of art-organization programs are accustomed to setting up personalized systems, specifying their own categories, and adding keywords. But with a CD, you can't add or delete keywords, nor can you organize libraries in a way that suits your work habits; the disk's contents are etched in stone (well, etched in polycarbonate plastic, anyway). And since PictureBase Retriever doesn't provide a master list of keywords, it's up to you to guess what words might be attached to the image you're seeking.

As I searched miles and miles of disk space, I became more and more frustrated. Image Club, for example, groups its artwork into the following PictureBase libraries: Headings, Humorous, Maps, Symbols, Mortices, and Clip Art. The Clip Art library is a 6000K catch-all for images that don't fit in the other categories; further division into sublibraries would have been helpful. Fortunately, Multi-Ad Services did a better job of organizing its libraries. However, if the image you need isn't in the library you suspect it's in, you're obliged to search all libraries, which can be excruciatingly slow on a packed CD.

As you search, you must wait for each image to appear on the screen. Some of the images—especially Image Club's—aren't centered in the PictureBase Retriever window, forcing you to scroll in order to see the entire drawing. Worse yet, when searching by keyword you're often treated to images totally unrelated to the one you're looking for, since any keywords containing the word you type will cause the associated picture to display. If you search for *car,* for example, you'll have to look at carrots, cartoons, credit cards, cartons, scary monsters, health care products, and so on.

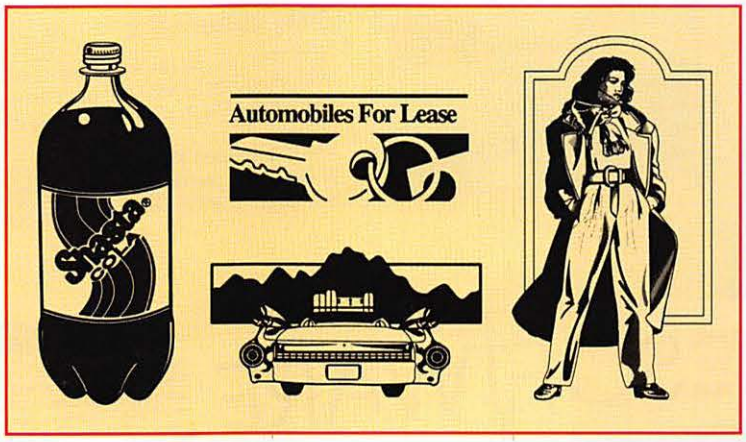
You can always search by title, but the library organization problem applies to this method as well; if you don't know which library a drawing resides in, you'll have to search all libraries. Furthermore, the titles listed in Image Club's printed catalog don't always match those on the CD. When titles do match, the same title often applies to several drawings. Fortunately, Multi-Ad's catalog is helpful and well organized.

One final problem: some drawings from each manufacturer contain several separate images. PictureBase Retriever provides no way to select a portion of a drawing, so you must either crop the drawing in your page-layout program or open the drawing with the parent program and separate it.

CD or Not CD?

As you can see, the technology for finding and retrieving clip art from compact disk is far from perfect. The problems I've mentioned are not entirely the fault of the clip art distributers—although more care should be taken in organizing material—nor of PictureBase Retriever, which was designed for hard disk–based collections. The problem lies with the medium itself; until users can write to CDs, more efficient methods of searching huge quantities of data must be found. An on-disk index would be a good start. Compact disks full of artwork are, in theory, a godsend for newspapers, art departments, and offices; it's up to the clip art distributors to make them so in practice.—*Erfert Fenton*

See *Where to Buy* for contact information.



Art Department Sampler
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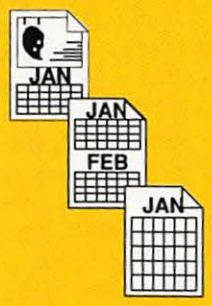
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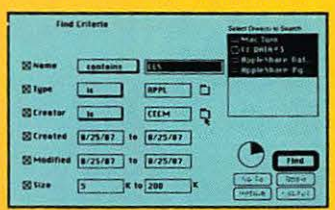
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Focus on Presentations

PC Viewer *PCV 6488AV*

LCD projector and interface. ***Pros:*** *High-contrast image is easy to see; compatible with IBM, Apple II, and other PCs.* ***Cons:*** *Image deteriorates and clouds on older, hot projectors; requires fine-tuning for optimal image.* ***Company:*** *In Focus Systems.* ***List price:*** *$1695 for projection unit; $119 for Mac Plus or SE interface.* ***Requires:*** *128K.*

MacViewFrame

LCD projector and interface. ***Pros:*** *Image is easy to see and stable, even on hot projectors; sturdy protective case.* ***Cons:*** *Not compatible with other PCs.* ***Company:*** *nView Corporation.* ***List price:*** *$1695 (includes interface for 512K, Plus, and SE).* ***Requires:*** *512K.*

Flat-Top *1.02*

LCD projector and interface. ***Pros:*** *Requires no additional power supply; projects more than can be shown on the original Mac screen; IBM compatible.* ***Cons:*** *Image lacks sharp contrast found in the other two units and deteriorates on hot projectors; software INIT must be included in System Folder; not compatible with 512K or 512KE.* ***Company:*** *Network Specialties.* ***List price:*** *$1495 for projection unit; $99 for Mac Plus interface, $195 for SE interface.* ***Requires:*** *1MB; Mac Plus or SE.*



FRED STIMSON

Liquid crystal display projectors for the Macintosh: (left to right) MacViewFrame, Flat-Top, PC Viewer.

Until recently, the only way to present Mac screen images to large groups was with expensive, bulky, and finicky projectors and monitors. Now there are three new products—PC Viewer (model PCV 6488AV), MacViewFrame, and the Flat-Top—that feature specially designed liquid crystal display (LCD) panels that work with standard overhead projectors so you can display chalkboard-size Macintosh screen images on classroom or boardroom walls.

Preview

Since the Macintosh has no standard video-out port, all three viewers require installation of a jack that taps into the computer's video signal. Because of the lack of standards, you can't freely interchange the three viewers with each other or with other projection devices. Installation of any of these units requires that a licensed technician open up the Mac and plug one or more connectors into existing sockets or circuit boards.

After installation of the video port, all three units are simple to connect and operate. With the MacViewFrame and the PC Viewer, you must also connect the viewer to the Mac with a cable, plug the viewer's power supply into a 110-volt outlet, and plug the LCD unit into the Mac.

The Flat-Top draws its power directly from the Mac, so it doesn't require an electrical outlet. But unlike the other two units, the Flat-Top won't display what's on the Mac screen unless the Mac's System Folder includes a special 9K INIT file. When this INIT is installed, you have the option of sending exactly the same thing you see on the 512 by 342 Mac screen to the LCD screen. Or you can take advantage of the LCD panel's 640 by 400 image to display more of your desktop, your spreadsheet, or your tree chart without scrolling.

The Flat-Top has only one hardware control: a contrast wheel that you'll probably never move from the maximum position. The MacViewFrame has a contrast knob and a switch that reverses the dark and the light pixels. The PC Viewer's touch-sensitive panel has buttons to control brightness, inverse video, location on the screen, and sequencing—an adjustment that sometimes needs to be made to eliminate a sparkle effect peculiar to the PC Viewer.

The View from Here

What about the display? None of the three units produces the black-on-white contrast of standard overhead transparency foils; each uses its own shade of blue, green, or yellow. The PC Viewer has the highest contrast, with a display that is crisp and clear when fine-tuned to optimal settings. The MacViewFrame projects an image that isn't quite as high in contrast but doesn't seem to require as much adjustment to keep it sharp. The Flat-Top's contrast ratio pales when compared with the other two, but the lack of contrast is at least partially offset by its wider viewing area. None of the three viewers displays rapid movements without blurring.

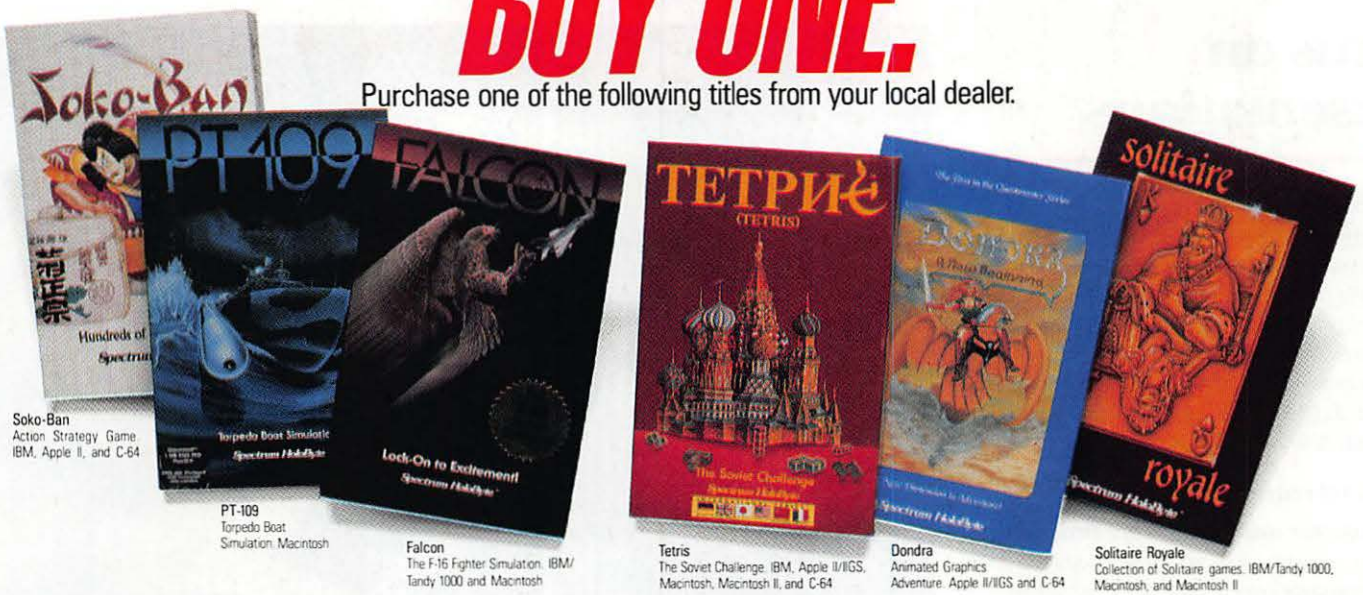
I demonstrated the PC Viewer and the MacViewFrame to a local user group on a high-quality overhead projector. Members seated around the 200-seat hall preferred the PC Viewer's image over that of the MacViewFrame by a five-to-one margin.

When I tested all three units on consecutive days in a large classroom, though, the PC Viewer earned just one of about 180 votes; the MacViewFrame was the clear class favorite, earning about twice as many votes as the second-place Flat-Top. The difference in outcome of these two popularity

(continues)

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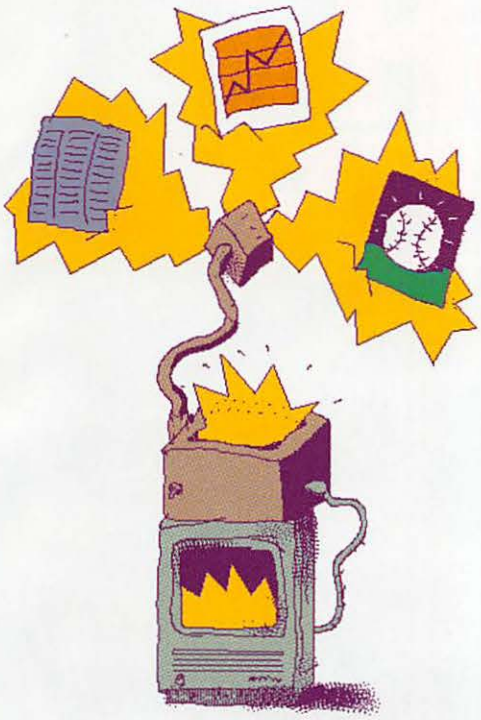
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contests boils down to one word: heat. The projector I used in the classroom test was an older model, and the two units without fans couldn't take the heat.

The MacViewFrame contains a fan to keep it cool, while the other two companies claim a fan isn't necessary when their viewers are used on most modern overhead projectors. Fortunately, most overhead projectors in use today operate well below the 140-to-150-degree maximum surface temperature recommended for these two units.

Overview

If you're looking for a machine that can display output from a variety of different kinds of computers, the PC Viewer is your best choice. Even if you only use it with a Mac, you'll probably prefer its clear, easy-to-read display, provided your projector doesn't double as a toaster. The Flat-Top is worth a look if you want to project more of the desktop than you can see on the Mac screen, and it's plug-compatible with the company's Big-Top and High-Top monitors. But if you need a Macintosh projector that can work well in the most adverse conditions, the MacViewFrame, with its cooling fan and hard-shell protective carrying case, is your best bet.

If none of these units meets all of your needs, then stay tuned: the LCD projector wars have just begun. —*George Beekman*

See *Where to Buy* for contact information.

Two Pages in One

Radius Two Page Display

19-inch-diagonal monochrome monitor. ***Pros:*** *Clear, stable picture; useful software enhancements.* ***Cons:*** *More appropriate for graphics than text.* ***Company:*** *Radius.* ***List price:*** *$1695, plus $695 for Radius TPD interface card; $1895 for gray-scale card for Mac II.* ***Requires:*** *Macintosh SE.*

Dedicated Mac users are perfectly comfortable with the nose-to-CRT pose encouraged by the Mac's classic 9-inch-diagonal screen. Nonetheless, even before Apple sanctioned the idea of larger screens with the Mac II, manufacturers began addressing the grumblings of a few obviously myopic malcontents by developing monitors readable from more than a foot away. Seriously, there are now many ways to supplement the Mac's screen, and one of the slickest is the Radius Two Page Display (TPD). If you usually work with graphics, engineering drawings, or spreadsheets, you may fall in love with the TPD. Those who work heavily with text may find Radius's Full Page Display (FPD) a better choice.

Seeing the Light

As the name suggests, the TPD is very nearly twice the size of the popular FPD. Whereas the FPD offers SE and Plus versions, the TPD is for the SE only (though there is an $1895 full-gray-scale interface card that allows you to use the TPD with a Mac II). Clarity is excellent at 1152 by 864 pixels, essentially the same density as the Mac screen. The high-contrast phosphor and fast screen-refresh rate do indeed make the large screen look paperlike, with no flicker, just as Radius claims.

Furthermore, the engineering in this product can't be faulted. If you install the TPD card yourself (absolutely not recommended—at these prices let the dealer do it) you will find a well-laid-out card with no hand-wired changes, and as simple an installation as is possible in the crowded SE. The monitor itself is a refreshingly clean design that minimizes weight (it's still 55 pounds) and sits on an adjustable stand.

The TPD system includes Control Panel software that allows you to place the SE and TPD screens next to each other and adjust them so that the cursor tracks without interruption between the two. A tear-off menu scheme lets you park most of the menus for your applications on the SE screen, leaving the TPD screen clear as a working area. A magnification feature displays blown-up sections of screen on the TPD or the SE. Sizing, centering, and zooming of windows can all be optimized through simple settings.

The TPD is compatible with nearly all best-selling software. The limitations are minimal: tear-off menus don't work under MultiFinder; scrolling, hierarchical, and HyperCard menus require special handling for tear-off; and the TPD doesn't support Switcher.

The $2400 Question

So, do you need a display system that costs nearly as much as a discounted SE with hard disk? Under certain circumstances, you might. If you work extensively with spreadsheets, you'll find this system ideal for displaying a year's itemized budget, month by month. The TPD isn't cheap, but it's a bargain compared to 19-inch color monitors for the Mac II. If you work with large graphics, you'll find using the TPD more efficient than using the scroll bars on an SE. In both financial and engineering applications, the use of Radius's $995 Accelerator (others are not TPD-compatible) is strongly recommended—the SE must write over five times the normal display area (SE plus TPD) and scrolling is slow in the stock system.

If your work is mostly text, the benefits of the TPD largely disappear. There is no comfortable desktop viewing distance for two pages of 10-point Helvetica, and screen curvature problems are exaggerated by close viewing. The per-letter pixel density is no better than the standard Mac display, so you can assess the readability issue for yourself. You could, of course, take the text up to 14 points, but then you have spent a lot of money for the privilege of reading your work from four feet away. For word processing applications, the Radius FPD is the better choice.

If you have a task that justifies the cost of a 19-inch monochrome monitor, the Two Page Display is a good choice. It provides a wonderful picture, and Radius offers superior technical support. With a TPD and a Radius Accelerator, the SE does a passable impersonation of a $10,000-plus workstation.—*Charles Seiter*

See *Where to Buy* for contact information.

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Low-Cost MIDI Interface Quartet

This review compares four low-cost MIDI interfaces for the Macintosh:

Apple Computer—Apple MIDI Interface.
Austin Development—MIDIface II.
Opcode Systems—Professional Plus.
Passport Designs—Passport MIDI Interface.

Information is provided on the number of MIDI inputs and outputs, external power supply requirements, and inclusion of required cables. All four interfaces require at least a Mac Plus.

By now you've probably heard about MIDI (musical instrument digital interface), the standard protocol that allows synthesizers to communicate with computers. There are over 200 Macintosh MIDI software packages in existence (commercial, public domain, and HyperCard MIDI stacks), and with the cost of synthesizers dropping to the $200 range, the MIDI boat is one you shouldn't miss. There is one catch, though: to convert your synthesizer's MIDI data into something the Macintosh can understand (and vice versa), you need a MIDI interface.

Variations on a Theme

To connect a Mac to MIDI devices, all you really need is an interface with one MIDI In port, one MIDI Out port, and a single cable (see "Room for Expansion"). Contrary to what you'd expect, this configuration doesn't limit you to a single sound device. A synthesizer, for instance, has a third MIDI port labeled MIDI Thru that passes information it receives to additional devices in a setup referred to as a *daisy chain*. Timing delays introduced between each MIDI In and MIDI Thru port limit the size of such MIDI networks to four synthesizers. For larger networks, some interfaces include up to six MIDI Outs, bringing the number of possible devices up to 16 and allowing *star* systems, in which each device has a dedicated MIDI Out port.

The MIDIface II offers the high-end option of using the Mac's two serial ports, allowing you to hook up two sets of 16 MIDI channels each. The result is a total of 32 MIDI channels, which can access 32 different sound sources simultaneously. It is possible to achieve the same effect by connecting one single-input interface to the modem port and another to the printer port. Either setup provides two discrete MIDI inputs that aid in synchronization applications.

Synchronizing a Mac with synthesizers, drum machines, tape recorders, and VCRs is a complicated process. Most sequencer and notation software now support the Song Position Pointer MIDI command. This feature permits devices to keep track of the number of elapsed 16th notes so that one device can instruct others to start at specific points on a track. Synchronization is possible using a single MIDI In, although synchronization while recording new data is not possible unless you add a somewhat costly MIDI merger peripheral. Having two MIDI Ins circumvents this restriction.

Once you've dedicated the Mac's serial port(s) to MIDI, you might wonder how you can access a modem or printer without continually swapping cables. High-end interfaces include built-in function switches, but for the MIDI interfaces reviewed here, you'll need a switch box or two (add $50 to $100).

Apple MIDI Interface

Apple entered the MIDI world when it introduced its single MIDI Input, single MIDI Output, single port interface last January. If you're new to MIDI and want to take the plunge with an inexpensive, easy-to-set-up, compact interface that requires no external power, this is the one for you. The $99 price, which includes two MIDI cables, makes it an excellent entry-level buy.

Austin Development's MIDIface II

Many musicians have not heard of Austin Development's interface because the company does very little advertising. This is unfortunate; MIDIface II is one of the two low-cost interfaces with two MIDI Inputs each assigned to three MIDI Outputs. (Word of a similarly priced two MIDI In, six MIDI Out interface, from Altech Systems, came too late for us to include the product in this review.) An internal switch (accessible by removing the back panel) can direct the modem port input to all six MIDI Outputs if desired. However, unlike high-end

(continues)

Four MIDI Interfaces

	Apple MIDI Interface	Opcode Professional Plus	Austin Development MIDIface II	Passport Designs MIDI Interface
Number of MIDI Ins and Outs	1 In, 1 Out	1 In, 3 Out	2 In, 6 Out	1 In, 1 Out
Mac connections (printer/modem)	either	either	either or both	either
Ins assignable to Outs	n/a	n/a	1 In maps to 6 Outs	n/a
Cables included (MIDI, Mac)	2 MIDI, 1 Mac	1 Mac	none	2 MIDI, 1 Mac
Power supply required	no	external (included)	internal	no
Dimensions (in inches)	2.625 × 1.25 × 1	1.25 × 3.875 × 1.375	3 × 5 × 2	1.25 × 4.5 × 2.5
Price	$99	$150	$119.95	$129.95

When considering MIDI interfaces, be sure to note that not all interfaces include the required cables, and that additional cables can be costly. Also, none of the interfaces in this table will fit under the Mac; they must be positioned either alongside or behind it. Both Opcode and Passport offer higher-end interfaces for additional cost.

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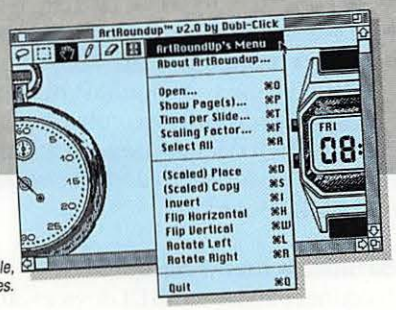
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MacUser gave WetPaint 5 mice (Sept. 1987) saying "...the WetPaint art is almost a must for clip art users; the ArtRoundup desk accessory is a neccessity." Volumes marked with ✳ were previously released as "MacMemories."

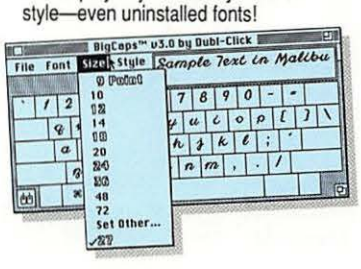
ArtRoundup comes free with WetPaint, and can Scale, Invert, Flip and Rotate the largest of paint-style images.

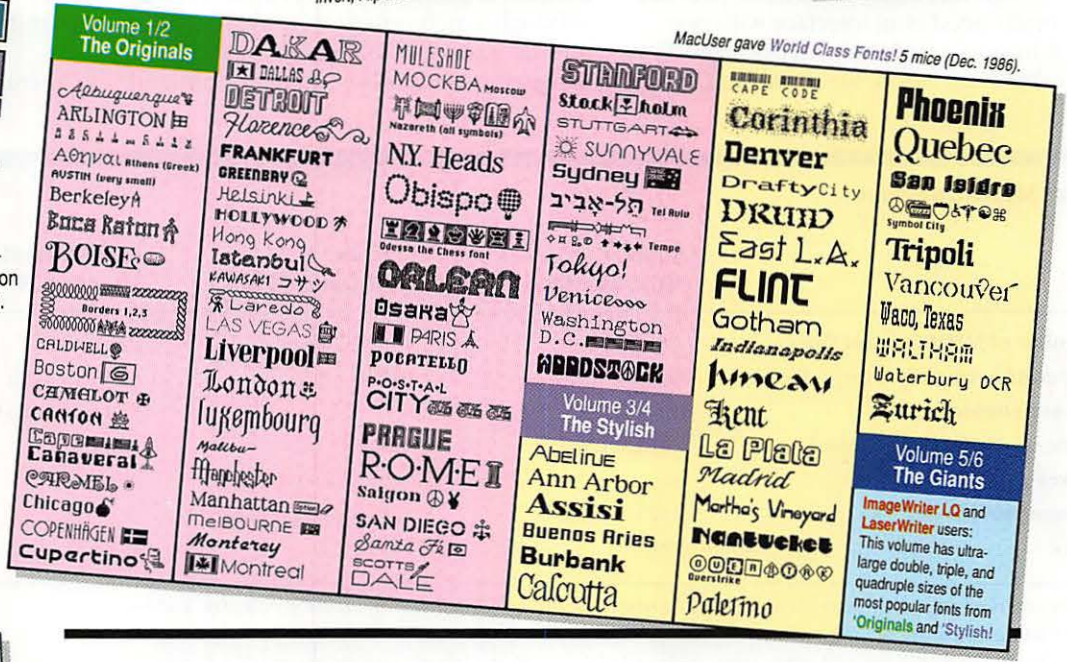
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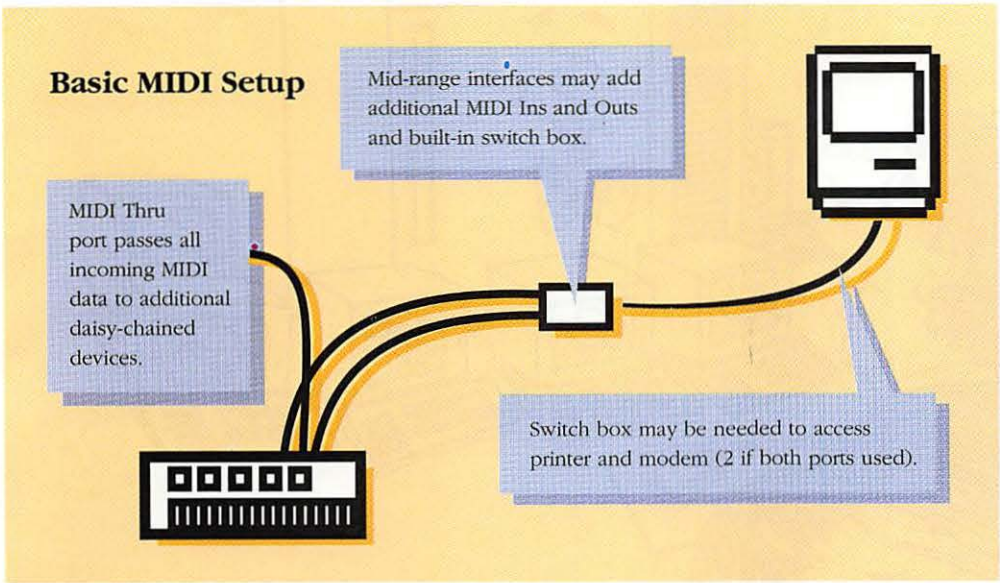
MacUser gave World Class Fonts! 5 mice (Dec. 1986).

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Room For Expansion

The basic MIDI setup requires a Macintosh, a MIDI interface (such as the Apple interface pictured here), and a single MIDI synthesizer. Specific applications and individual hardware preferences will determine what type of interface is required, as well as the kinds of interface peripherals needed.

devices, which also have two MIDI Inputs and six MIDI Outputs, the internally powered MIDIface II cannot be used in place of a MIDI Thru box (a peripheral designed to reroute outgoing MIDI data) while the Mac is doing something else. The $119.95 price seems low, but keep in mind that it does not include the required Macintosh cable (about $30) or any MIDI cables ($18 to $25 per pair).

Opcode Systems' Professional Plus

The Professional Plus is the descendant of the first Macintosh MIDI interface, Opcode's MIDIMac Interface. It has a single In, three Outs, and requires an external power supply (included). Essentially, the Professional Plus is one-half of Opcode's popular high-end Studio Plus II interface minus the switches and status LEDs, at well over half the price. The Macintosh cable is included, but you will still need a pair of MIDI cables. With this in mind, the $150 price may seem steep. On the other hand, Opcode has a good reputation for quality and reliability. Opcode also markets a synchronization peripheral, the Timecode Machine.

Passport MIDI Interface

Passport's interface specs out exactly like Apple's: it's an entry-level interface with a single MIDI In and MIDI Out, no power supply required, and all cables included. The unit is slightly larger than Apple's and the price is slightly higher: $129.95. Passport also markets a high-end interface/sync box, the MIDI Transport, which provides many of the features offered by Opcode's Studio Plus II/Timecode Machine combination. Passport discounts the interface when it's bundled with Master Tracks Pro Sequencer.

All Shapes and Sizes

Although there are other interfaces with features similar to Opcode's and Passport's high-end models' (for instance, Southworth's Jambox series and Sonus's MacFace and SMX 2000), no single product has everything. So the number of Ins and Outs becomes a primary consideration when you are buying an interface. Also keep in mind the additional expense of cables, future expansion to a system with two Ins, and synchronization capabilities. You may even want to look at packages that bundle software and interfaces.

—Christopher Yavelow

See *Where to Buy* for contact information.

Real Color Now

ColorBoard 104

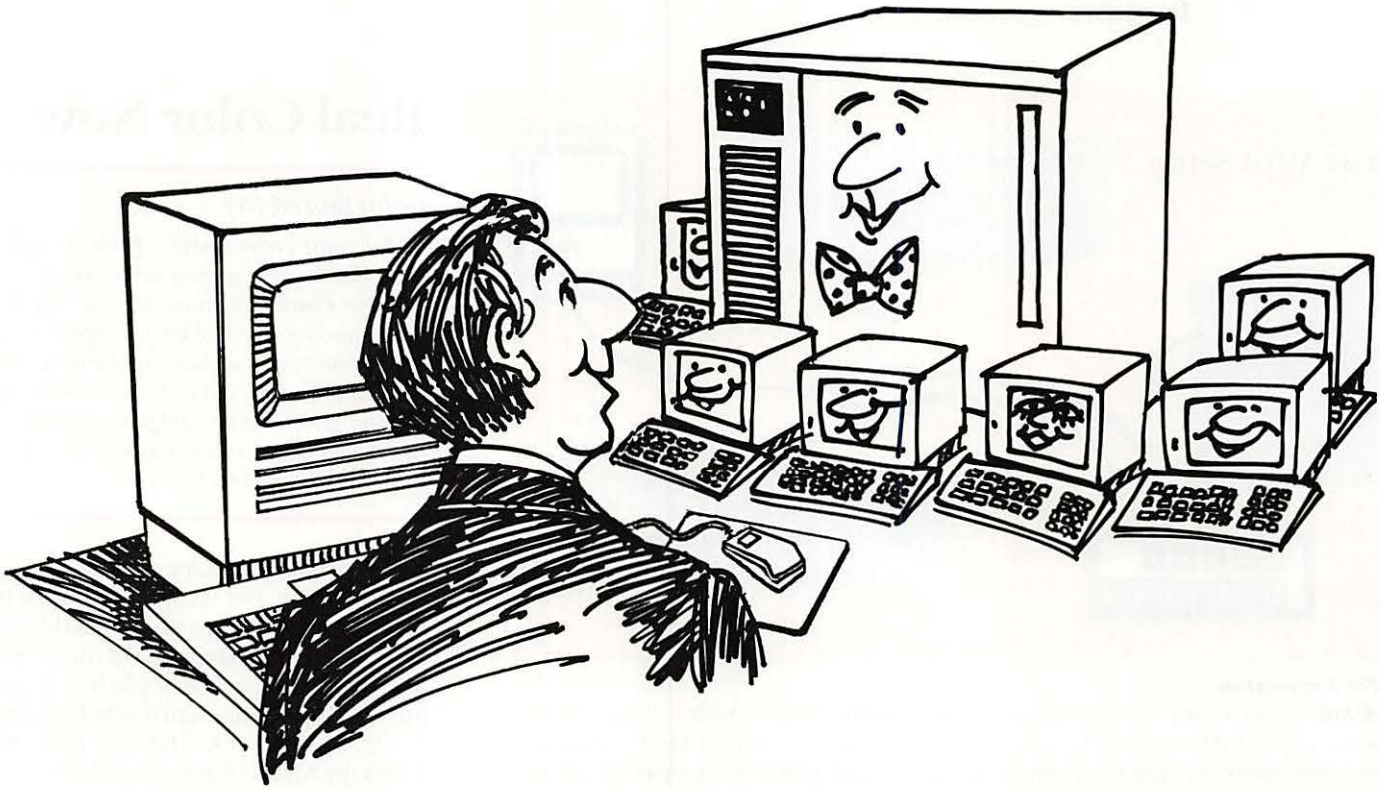
24-bit color video card. ***Pros:*** *Provides near-photographic-quality color; eliminates banding.* ***Cons:*** *Expensive; slow; no official Apple support for 24-bit color; few input/output devices available; no software yet for developers; can't revert to 8-bit color without rebooting.* ***Company:*** *RasterOps.* ***List price:*** *$3195.* ***Requires:*** *Mac II; color monitor. (ColorBoard 64 available for 13-inch monitor.)*

Standard color on the Mac II looks great, but it could look even better. At 24 bits per pixel, the Mac II is capable of displaying all of the 16.8 million colors into which Apple has divided the color spectrum. Currently, however, Apple supports only 8 bits per pixel, which limits the Mac to displaying 256 colors at a time. While it is difficult to imagine an original work of art with more than 256 colors, photographic-quality images require a much wider spectrum. The subtle shadings of real life quickly exceed Apple's 256-color limit, and banding (visible transitions within color regions that should blend smoothly) results. Harnessing the Mac II's 24-bit-per-pixel capacity solves the banding problem and renders images with lifelike quality—every pixel on the screen can assume any of over 16 million colors.

But there are severe limitations to using 24-bit color. First, since Apple doesn't yet officially support 24-bit color, most software companies are delaying development of 24-bit graphics applications. Second, input and output devices for 24-bit color are rare and expensive. Third, screen refresh is very slow because the Mac II draws the screen three times—once for each primary color. The problem will persist until Apple releases a version of Color QuickDraw that directly supports 24-bit color.

RasterOps' ColorBoard is one of the first 24-bit color video cards for the Mac II. RasterOps has squeezed three 8-bit primary-color circuits onto two cards, which are bolted together. Although the ColorBoard fits into one NuBus slot, it draws as much power as three normal cards, so you'll need to be careful how many other

(continues)



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cards you install. The board provides standard 72-dots-per-inch resolution (1024 by 768 on a 19-inch screen).

The software consists of a CDEV that you install by dragging its icon into the System Folder. The Mac II then boots up in the 8-bit mode and, as with Apple's standard color card, you switch between gray scale, 8-bit color, and monochrome using the control panel. To shift to 24-bit color, you double-click on the RasterOps icon in the Control Panel. To shift from 24-bit color back to one of the usual modes, however, you must reboot. To make all these changes more convenient, RasterOps includes QuicKeys—a utility that allows you to assign ⌘-key combinations to menu choices.

Works Fine, But . . .

In more than a month of using the RasterOps board, I found no serious bugs, nor did the board cause any system crashes. To get the 24-bit mode to work properly, however, you have to modify the System file or use the one supplied by RasterOps. Additionally, the cursor tends to flicker and change colors. But these are minor annoyances. Most software works fine with 24-bit color. (Apple has stated that the implementation of 24-bit color used by RasterOps should work properly with all software that follows Apple's 8-bit-color guidelines.) I pasted 24-bit color images into PageMaker, ReadySetGo, and XPress and resized, moved, and rotated them. Because the screen refresh rate is so slow (just try scrolling text and watching each line draw three times as it moves up the screen), I recommend working in the 8-bit mode when 24-bit color is not required.

Programs designed specifically to take advantage of 8-bit color, however, may have compatibility problems. For instance, when a 24-bit color picture is pasted into Modern Artist or PixelPaint, the entire screen breaks up into random colors, forcing you to reboot to return to normal. On the other hand, LaserPaint Color II can display 24-bit color images and can produce color separations. With LaserPaint, you can import images, such as those from PixelPaint, and display them in 24-bit color. The program also contains the only Mac driver for the Sharp JX 550 color scanner (one of the few ways a 24-bit color image can be imported).

Users hoping to do desktop publishing in color shouldn't expect too much too soon. Spot and line color can be done nicely at 8 bits per pixel. But screen images in 24-bit color look better than the output from 300-dpi printers. To get output as good as the screen image, you must use a 24-bit film recorder or high-quality, four-color printing press, neither of which is currently available for the Mac.

How Much?

Price is sure to keep most users from considering 24-bit color. A 19-inch Trinitron monitor with the ColorBoard costs nearly $6600. Some people would rather buy a car. A slightly less expensive alternative is RasterOps' ColorBoard 64, which has the same quality 24-bit color at the same resolution but works with a smaller 13-inch monitor. Though the savings on the ColorBoard 64 is only $600, the savings on, say, an Apple Color monitor versus the 19-inch Trinitron is $2700, so you can get a complete video setup for $3300.

Until RasterOps speeds up the performance of its ColorBoard and until more input/output devices and software are available, 24-bit color will remain an unjustifiable expense for most people. In a couple of years or so, however, 24-bit color may well be the affordable standard we wish it were now.—*Scott Beamer*

See *Where to Buy* for contact information.



DAN ESCOBAR

Clouds vs. Clouds *These two pictures demonstrate the huge difference between 24-bit color (top) and 8-bit color (bottom). In the 24-bit image, the clouds have a photographic quality; the 8-bit image looks much rougher. Unfortunately, applications that support 24-bit color are rare, as are input and output devices that support it.*

Macintosh Rising

MacAstrologer *1.0*

Astrological charting program. ***Pros:*** *Simple chart generation with beautiful LaserWriter output; thorough, professional documentation.* ***Cons:*** *No online help function.* ***Company:*** *Full Phase Software.* ***List price:*** *$179.95.* ***Requires:*** *128K.*

MacAstrologer generates nearly every type of popular astrological chart, as well as some more obscure ones. It was designed for use by people whose everyday chitchat refers to ecliptic coordinates and sidereal zodiacs, and it has been priced likewise—in a way that discourages casual dabblers. Although *Macworld* is not, of course, endorsing astrology per se, this program produces charts that a refined, artistic Libra would be sure to love, and it provides documentation to satisfy the fussiest Virgo.

Aspects of the Program

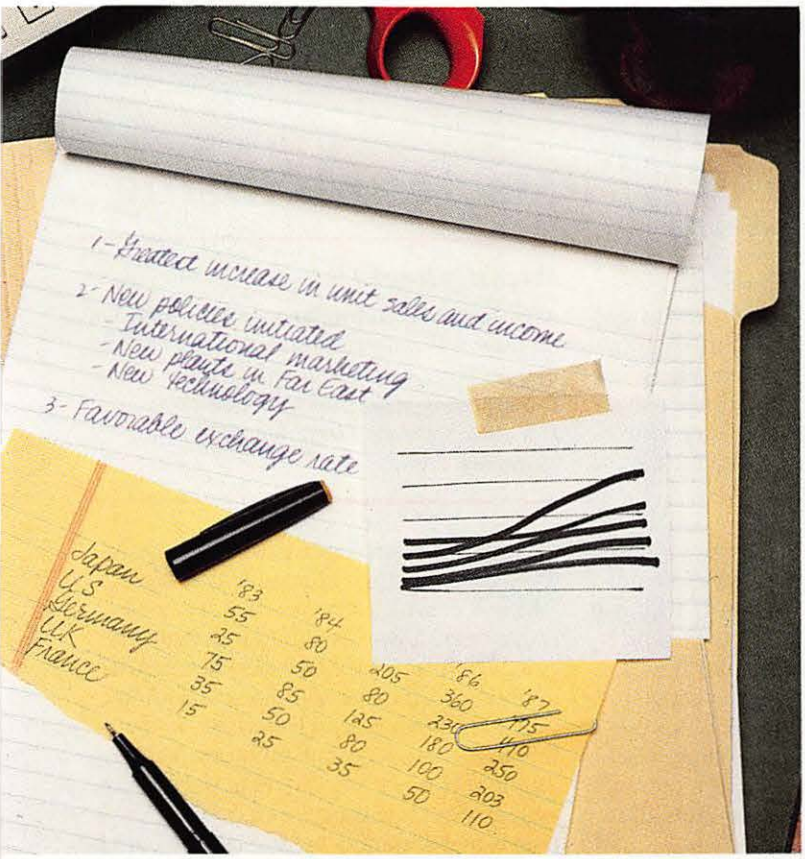
From a computing standpoint, astrological charts are the inverse of navigational charts. In celestial navigation, you use the time and the position of heavenly bodies to determine a location; in astrology, you are given the time and location (of a person's birth) and must then determine the position of the sun, moon, and planets. This has traditionally been done using sets of tables called ephemeris, but the tables are difficult to use and require multivolume sets to cover long periods of time.

MacAstrologer simply replaces all those tables with internal formulas for performing chart calculations. You enter birth

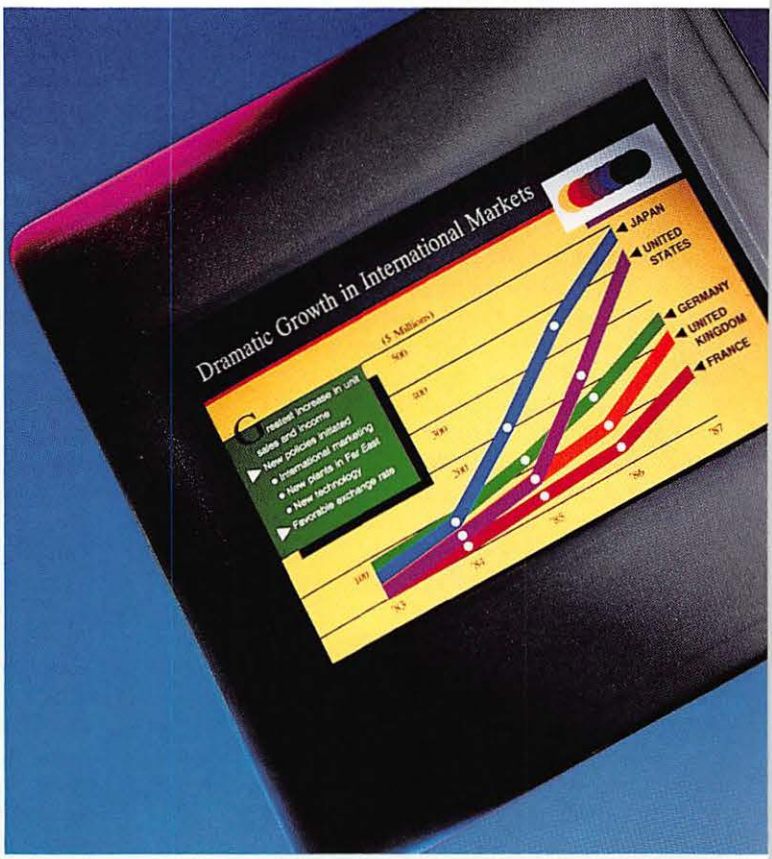
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time and place data in an input window, and a finished chart pops up in a second or so (all input/output functions are directed by dialog boxes in separate windows).

What sets this program apart is flexibility in chart presentation—using its design window, you can modify most features of data presentation for aesthetic appeal or interpretational emphasis. Chart types include natal, solar return, lunar return, composite (derived and midpoint), and progressed. MacAstrologer allows you to choose tropical or sidereal zodiacs, based on ecliptic, heliocentric, or right ascension coordinates for calculating those charts; and it displays Placidus, Koch, Porphyry, Equal, or Campanus house systems. All variations of the above may be crammed onto one chart or displayed separately (see "Solar Energy"). Through a series of dialog box choices, any calculable piece of information in the whole system can be presented or suppressed in a particular display.

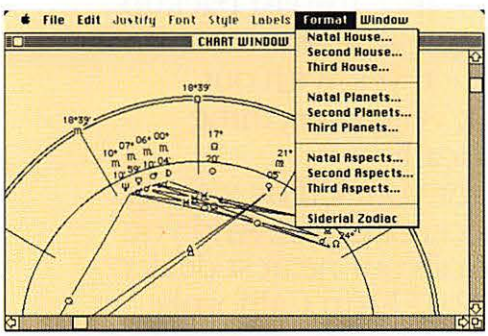
Planetary Circuits

Although using a 68000 processor in support of this mystical view of man's fate highlights some curious contradictions in our culture, there's no denying that the resulting charts, particularly when printed on a LaserWriter, are spectacular and interesting in and of themselves.

Professional astrologers should note that MacAstrologer's batch mode can store and process up to 50 client files at a time. This means that the program can compress about two weeks worth of chart drawing into a 20-minute automated session—that's the program's strongest economic appeal. Another plus is Full Phase Software's customer support, which is prompt and helpful.

For simple recreational use, Graphic Astrology (version 2.3), a $39.50 program from Time Cycles Research, would be more appropriate. But for serious practitioners, MacAstrologer is a complete and well-designed system.—*Charles Seiter*

See Where to Buy for contact information.



Solar Energy
This plain-vanilla natal chart (of a Libra with rather a lot of items in Scorpio) has been redrawn—with some choices from the Format menu—to display a small set of Aspects. The full range of display possibilities is nothing short of mind-boggling.

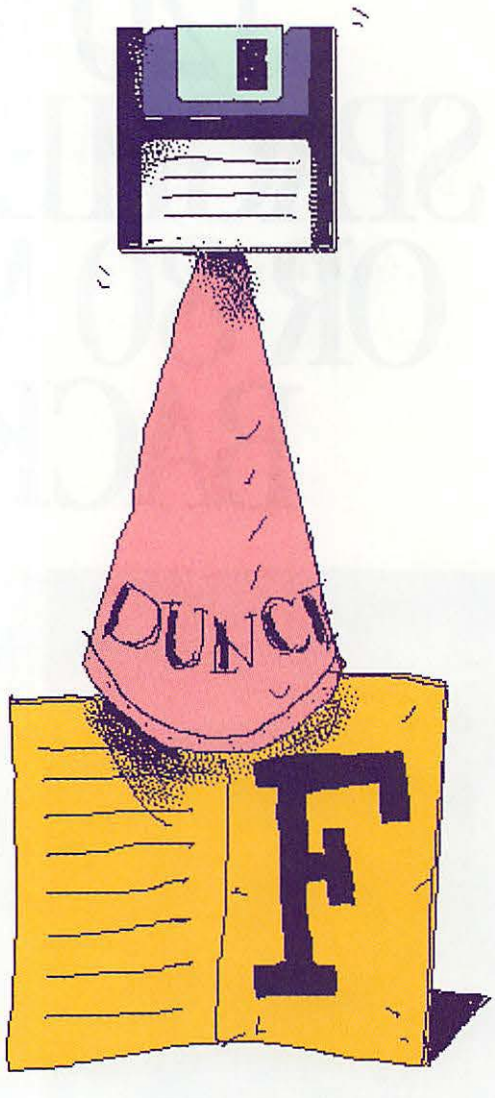
Getting It Right

MacProof 3.0

Grammar, punctuation, and spelling checker. ***Pros:*** *Desk accessory; can check part of a document; points out weak paragraph and sentence structure.* ***Cons:*** *Loses text formatting with some applications; can't mark errors; doesn't recognize words with curly apostrophes; misses many grammatical errors.* ***Company:*** *ALP Systems.* ***List price:*** *$195.* ***Requires:*** *1MB; two 800K drives; hard disk recommended.*

Sensible Grammar 1.1a

Grammar and punctuation checker. ***Pros:*** *Suggests alternatives for problem words or phrases; can flag problems for later work.* ***Cons:*** *Can't be used within a word processor; only checks whole documents; no spelling checker; misses many grammatical errors.* ***Company:*** *Sensible Software.* ***List price:*** *$99.95.* ***Requires:*** *512K; hard disk recommended.*





Even if you can't tell a split infinitive from a subordinate clause, you'll probably agree that proper grammar, usage, and punctuation makes writing more effective. Word processors—even ones with spelling checkers—are fine for entering text, but they'll accept "its OK" without batting an electronic eyelash. MacProof and Sensible Grammar claim to go a step further by pointing out flaws in wording and punctuation.

Mac Proofreader

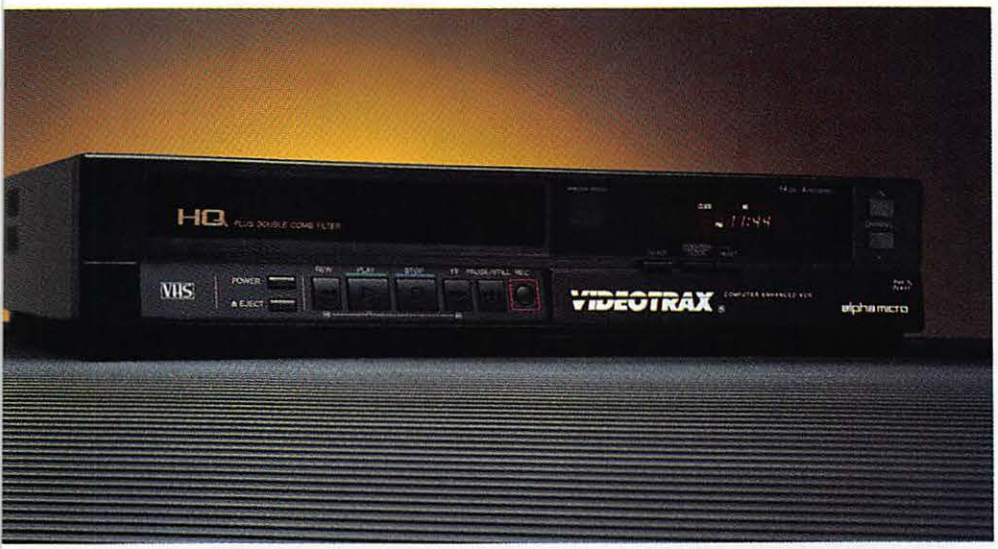
MacProof is a desk accessory that scans text for mistakes in mechanics (including spelling), usage, and style. An easy-to-use checklist lets you pick which types of errors to look for. When it catches a potential problem, MacProof shows the suspect word or phrase in context, along with a short explanation (see "Checking It Out"). You don't have to leave MacProof to edit the document, but you can revise only one sentence at a time.

The Analyze Structure function is supposed to help you recognize structural weaknesses by letting you look at your writing in different ways. For example, you can highlight the opening and closing sentences of every paragraph or the first words of every sentence. Analysis is minimal, though—it's up to you to decide if you're satisfied with what you see.

MacProof only examines selected text, so you can check a single word or an entire chapter. But with some applications (including Microsoft Word) all formatting dis-

(continues)

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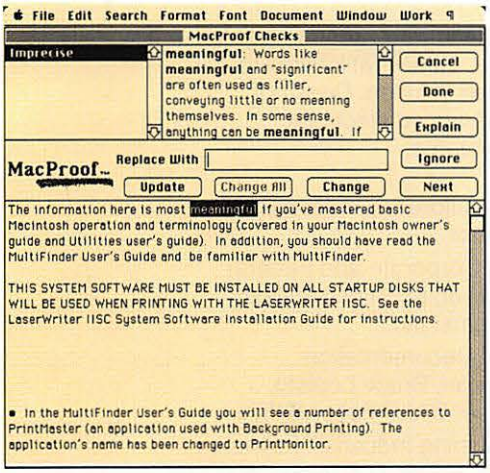
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appears if you make changes in MacProof. (Of the programs I tried it with, MacProof worked perfectly only with MacWrite. It wasn't compatible with ReadySetGo 4.0 or a beta version of FullWrite Professional.) Just as annoying is MacProof's inability to recognize words with curly apostrophes like the one in "can't."



Checking It Out
Querying the word meaningful, *MacProof tells you what the problem is, but doesn't suggest any improvement.*

Sensible Choices

Sensible Grammar isn't a desk accessory, so you have to quit the word processor you're working in to use it. (Running both programs under MultiFinder helps, but you still have to save a file before checking it.) Sensible Grammar handles Microsoft Word, PageMaker, MacWrite (version 4.5 or later), and plain text files. Once you've opened a document, there's no turning back—if you stop partway through, you lose any changes you've made. Sensible Grammar doesn't check spelling, and it can't display selected sentences and paragraphs the way MacProof can.

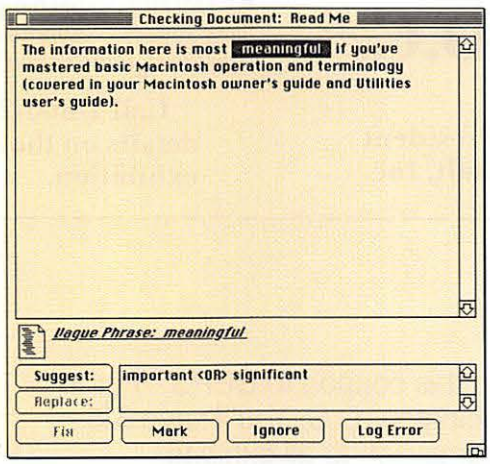
On the other hand, Sensible Grammar is more flexible than MacProof for reviewing manuscripts. I like the way it usually offers a list of suggestions when it finds something that might need correction (see "Suggestions, Anyone?"). Unlike MacProof, Sensible Grammar lets you mark problem areas for later attention; you can then deal with the flagged areas in a word processor. Sensible Grammar keeps track of homophones (like *to* and *two*), but it displays them in a separate window: whether you'll consider this a bug or a feature depends on how often you confuse such words.

Failing Grades

To test Sensible Grammar's and MacProof's ability to verify grammar and punctuation, I ran a simple five-sentence test: The captain wants to see I today. (*I* should be replaced by *me*.) Jack was more smarter than Jill. (*More* should be omitted.) A flock of birds come to stay every night. (Should read *comes*.) I feel horribly today. (Substitute *horrible* for *horribly*.) He came he saw he conquered. (Missing commas.)

None of these mistakes are especially subtle, yet neither program picked up a single one. (For the record, Doug Clapp's Word Tools, a competing application, couldn't detect any problems either.) On grammar and punctuation, both Sensible Grammar and MacProof rate an F.

The failure to detect those simple errors isn't too surprising when you realize that neither program is intelligent enough to understand what it reads. MacProof and Sensible Grammar work by comparing text against lists of troublesome words and phrases, so they do better at finding specific words that should be avoided because they're corny, pompous, sexist, racist, or just plain dull. MacProof and Sensible Grammar are more adept than most spelling checkers at spotting typos, especially words that aren't capitalized correctly.



Suggestions, Anyone?
Sensible Grammar isn't happy with the choice of words, but it offers some alternatives. Clicking on Suggest shows what the suggestions look like in context.

It's a sure bet that these programs won't put editors out of business. If grammar and punctuation are your weaknesses, you'd be better off with a good writer's handbook. But if your prose suffers from overworked clichés and typographical errors, I'd recommend Sensible Grammar. Even though it's not as convenient to use as MacProof, in my tests it did a more credible job of pointing out problem words and offering reasonable suggestions for improvement. It's also easier to customize the phrase lists that Sensible Grammar bases its judgments on. At almost a hundred dollars cheaper, it's a better value than MacProof, too.—*Franklin Tessler*

See *Where to Buy* for contact information.

Machine Slaves

QuickShare

Mac-PC file-transfer program and PC card. ***Pros:*** *Fast file transfers; PC remains functional.* ***Cons:*** *Limited file translations.* ***Company:*** *Compatible Systems.* ***List price:*** *$465.* ***Requires:*** *Mac with SCSI port.*

Lap-Link Mac 1.2

Mac-PC file-transfer program. ***Pros:*** *Works in background under MultiFinder; inexpensive; versatile wild-card file selection.* ***Cons:*** *Requires some knowledge of MS-DOS; no file translations.* ***Company:*** *Traveling Software.* ***List price:*** *$139.95.* ***Requires:*** *128K.*

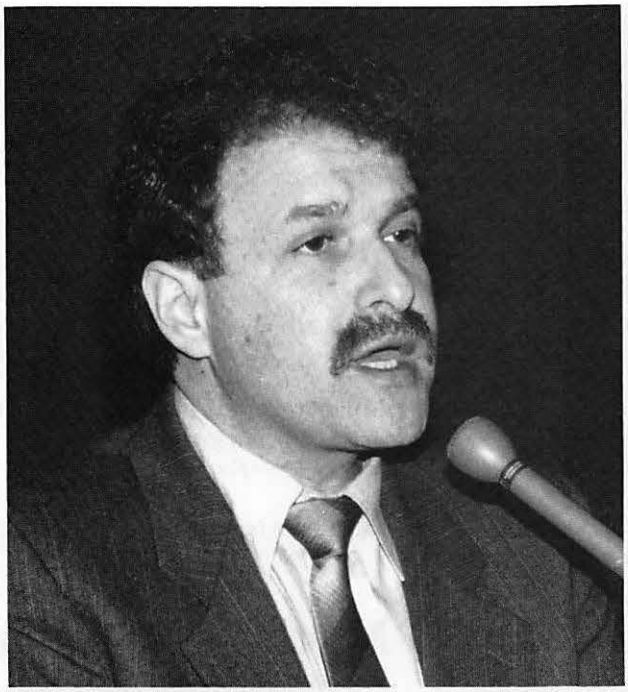


In addition to such networking solutions as AppleShare PC and TOPS, two new programs provide evidence that peaceful coexistence between Macs and IBM PCs is possible. QuickShare uses a PC card to link a Mac to a PC's hard disk, and should solve many file translation problems (although it only works in one direction—to the Mac). Lap-Link Mac is a slower file-transfer aid. It links serial ports but forces you to look elsewhere for file translation.

QuickShare: Mac as Master

If your Mac's an orphan with no hard disk, but you've got a PC lying around, you

(continues)



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- "Desktop Publishing: Personal Productivity Tools for the 1990s," keynote speaker, Theodor H. Nelson, Inventor of the concept of Hypertext and designer of Xanadu™
- "Office Publishing: the Future of Work Processing," keynote speaker, Henry Ancona, Vice President of Business & Office Information Systems, Digital Equipment Corp.
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can use QuickShare to link the two and let the Mac use the PC's hard disk as its own. QuickShare's PC card provides a SCSI link between the Mac and the PC's hard disk; the PC card has only one SCSI port so you'll have to make sure that the PC disk is the last device on the Mac's chain of SCSI devices. Installing the card in the PC is straightforward, and even though you can change the DIP switches on the card to avoid conflicts with other PC cards, I didn't find it necessary to do so on two PCs with different configurations. QuickShare doesn't give you access to all of the PC's hard disk; it lets you create a special file of any size on the PC (called the *virtual disk*) that serves as the Mac's portion of that hard disk. You access the virtual disk via the SCSI port. Starting up the PC with a program titled QUICKSHR.EXE enables you to use the virtual disk.

The Mac recognizes the QuickShare virtual disk as an ordinary Mac hard disk. Once you initialize the virtual disk, you can transfer System files and applications to it and even boot the Mac from that disk.

In addition to letting a Mac and PC share the same hard disk, QuickShare includes PC Transfer, a Mac program for transferring and translating PC files to the virtual disk. PC Transfer lets you transfer files in a byte-for-byte mode; you can transfer Lotus 1-2-3 WKS files for input into Excel, for example. Programs that operate on both Macs and PCs, such as Microsoft Word, PageMaker, and WordPerfect, can make good use of this option. For other programs, you can transfer ASCII files; PC Transfer strips line feeds from the PC file so that a program like MacWrite can read it. QuickShare's QSPC program lets you capture PC print files in a format that can be translated (by PC Transfer) to MacPaint or MacWrite files for use on the Mac.

Lap-Link Mac: PC as Master

Lap-Link Mac takes a different approach: it uses an ordinary RS-232 cable to link a Mac and a PC, and the program that controls file transfers resides on the PC. Because the PC side controls Lap-Link Mac, you need some familiarity with PC commands. The Lap-Link manual attempts to provide the necessary information on using PC commands, but some of the program's structure would be unclear even to people who use PCs daily.

Lap-Link Mac is designed to transfer text-only files and files from programs such as Word, WordPerfect, PageMaker, Excel, and dBase II and III between Macs and PCs. Lap-Link Mac doesn't attempt any translations between different types of files, it merely allows you to transfer files between both machines. If you plan to use a WordStar file on the Mac, for example, you can transfer the file with Lap-Link Mac, but you'll have to use another program, such as Apple File Exchange or MacLink Plus, to translate the file. As for the file transfer, you could accomplish the same thing by using terminal emulation programs on both the Mac and the PC.

File Formats

Product	File Formats
QuickShare	Any PC word processor → MacWrite
	PC screen dumps → MacPaint
	ASCII text files (add/delete line feeds)
	MacBinary
	Byte Image (Lotus WKS, PageMaker, dBase III)
Lap-Link Mac	MacWrite, Microsoft Word, WordPerfect, Excel, PageMaker
	ASCII text files (add/delete line feeds)
	Any PC word processor → ASCII text file

File Formats
QuickShare and Lap-Link Mac can both handle ordinary text files, as well as file formats common to programs that currently exist on both Macs and PCs. QuickShare has more flexibility in handling the formatted output from PC word processors.

Lap-Link Mac is compatible with MultiFinder, so you don't have to slave the Mac to a PC. Once you start the Mac program of the Lap-Link Mac package, you can keep it running in the background under MultiFinder and let someone handle the file transfers on the PC.

How Do They Stack Up?

The proximity of Macs and PCs in your office may be a deciding factor in selecting one of these programs. QuickShare requires that the Mac and PC be no more than 10 feet apart. Lap-Link Mac is a bit more forgiving because, although a Mac and PC must be close together, the Mac can serve as a gateway to a TOPS network whose volumes can be accessed by Lap-Link Mac.

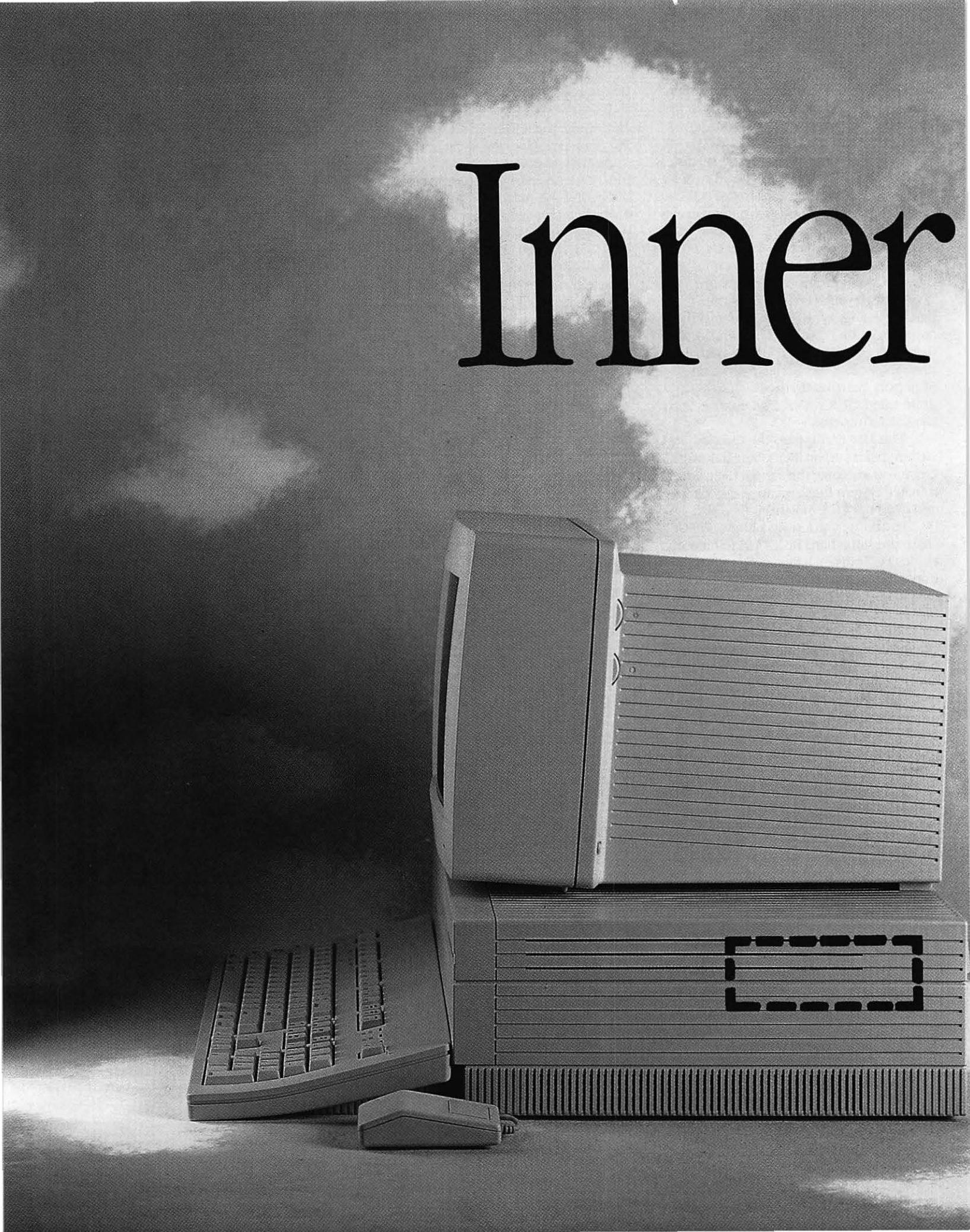
Speed is an important factor if you're transferring a large number of files. Because it uses the SCSI port, QuickShare is by far the fastest at transferring files. QuickShare's file-transfer speed depends greatly on both the PC's processor speed and the hard disk speed. Even at its slowest speed, QuickShare is still faster than Lap-Link Mac or MacLink Plus. Typical transfer rates with QuickShare are about the same as with Apple's old non-SCSI HD20; in most instances, a QuickShare file transfer takes two-thirds the time of a transfer using TOPS. Lap-Link Mac takes about ten times as long as QuickShare. Also, although Lap-Link Mac's raw data rate is 57.6 kilobits per second and MacLink Plus's rate is 9.6 kilobits per second, Lap-Link Mac transfers files only about two to three times faster than MacLink Plus.

If you're interested in high-speed transfer of lots of PC files to a Mac, QuickShare makes sense. QuickShare's QSPC program is a clever way to convert PC word processor files into MacWrite files without special translators such as MacLink Plus's. But remember, you cannot translate Mac files back to PC formats unless you use an extra program like MacLink Plus.

If you're familiar with MS-DOS commands, you probably won't mind using Lap-Link Mac for transferring files, but I can think of dozens of terminal emulation programs on the Mac and PC that can handle the same transfers just as well. Lacking file translation features, Lap-Link Mac isn't anything special.—*Dave Kosiur*

See *Where to Buy* for contact information.

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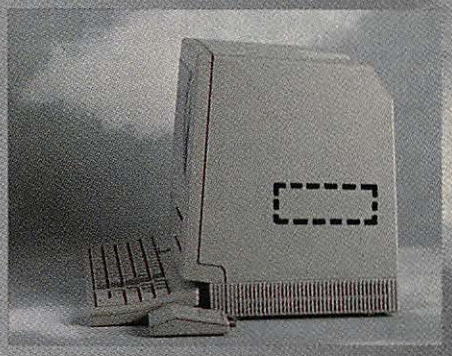
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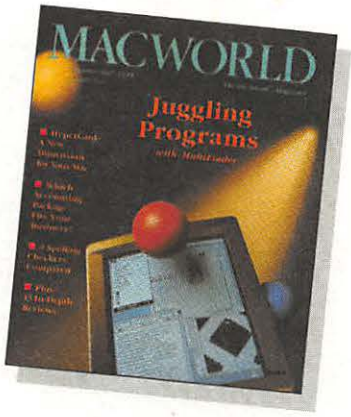
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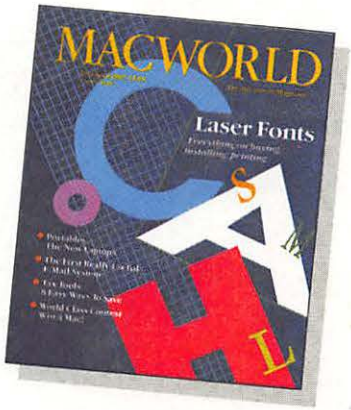
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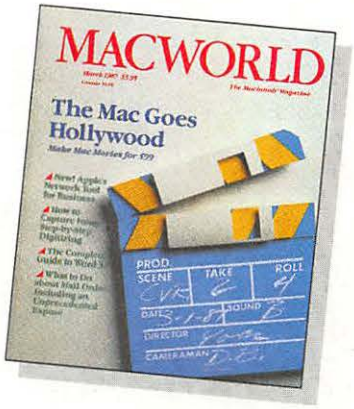
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New Products

Information on the Mac's latest software, hardware, and accessories

Edited by Eileen Drapiza

This section covers Macintosh products formally announced but not yet evaluated by *Macworld*. All prices are suggested retail. Please call vendors for information on availability.

SOFTWARE

Bid Analysis Microsoft Excel template designed for any bidding situation. Features analysis of cost recovery probable on first successful bid, division of bid into components, bid adjustment, ability to integrate last-minute sub-bids and to forecast risk exposure indicated by percentage of bid components. Allows you to massage the bid. 512K min. memory. $249. Hewpact Ltd., 613/389-3200.

CAD PAC Desk accessory enhances MacDraw II's accuracy and performance with four CAD extensions: sizing and reporting, adjacency, extend and clip, and filleting. Extensions have keyboard equivalents for fast activation. Works on rotated objects. 128K min. memory. Price to be announced. Paracomp, 415/543-3848.

CBT Development Stacks Toolkit for developing and delivering interactive computer-based training. 1MB min. memory; requires second disk drive and HyperCard. $135. First Reference, 212/730-8211.

ChemIntosh Desk accessory lets you draw chemical structures without quitting your current application. Includes standard application features like Undo, on-screen help, printing, and resizing objects. $295; educational discounts available. SoftShell Company, 716/334-7150.

ChemStack Facilitates chemical structure construction and indexing. Includes major ring systems, compound types, and a full set of structural building blocks. Online manual explains new structure construction and adds new structures to the library for rapid retrieval and customizing. May be used in conjunction with DrawStuctures. 1MB min. memory; requires HyperCard; hard disk recommended. $80; $40 for registered users of DrawStructures; educational discount available. Modern Graphics, 317/253-4317.

Cube and Tess Cube is a computer-based version of the famous six-color cube puzzle. It can be manipulated by pointing and clicking. Combines single moves into sequences that can be replayed in forward or reverse. Tess is a 4-D version. Can also be used as an instructional aid to illustrate basic concepts of group theory in three and four dimensions. 128K min. memory. $24.95. Atlantic Software, 617/922-4352.

FontMaster '88 Public domain font editor utility can create a large number of styles from a single font, and create font families. T Tauri SoftSystems, 416/690-5886.

Glatt Plagiarism Teaching Program Tutorial instructs students about what constitutes plagiarism and how to avoid it. Teaches the difference between plagiarizing and paraphrasing, and when and how to provide proper attributions. Includes Self Plagiarism Detection Test for immediate feedback. $250. Glatt Plagiarism Services, Inc., 916/483-8773.

Health Care 1 Clip art collection stored in MacPaint, MacDraw, and FullPaint files. Contains more than 200 images. Includes a how-to guide, pictorial index, and permanent storage case. $74.95. Dynamic Graphics, 309/688-8800.

HyperAtlas Allows access to geographically based data in HyperCard stacks. Comes with basic data for countries, and users can also use the map interface to display their own data. Country names on maps are linked to information stacks containing cards for each country. $99. MicroMaps Software, Inc., 609/397-1611.

HyperBase-Home Replaces the Home Stack that comes with HyperCard. Features simple stack installation. Lets you launch applications or stacks from HyperBase-Home, and returns to it on quitting. Unlimited number of installed stacks; fully compatible with MultiFinder; built-in text editor, screen saver, and HyperHelp. Lets you Copy, Delete, Rename, Get File, Create New Folder, and open and delete stacks from HyperBase-Home. $20; free 30-day trial version available on CompuServe and GEnie. HyperBase Software, 58 Waverley St., Belmont, MA 02178.

HyperText '87 Digest Stand-alone hypertext document containing summaries of more than 100 position papers written by leading authorities. Contributors include Ted Nelson, K. Eric Drexler, Esther Dyson, Frank Halasz, Kirk Kelley, Stephen Weyer, and Nicole Yankelovich. Topics range from storage management for global hypertext libraries to hypertext applications in linguistics, archaeology, and medicine. 512KE min. memory. $10. Eastgate Systems Inc., 617/782-9044.

KeyCap Fonts Consists of three font sets: KeyCap Ovals, ASCII screen-graphics characters, and gray halftone boxes. The sets include pictures of computer keys and screen images in document files. 128K min. memory. Requires a PostScript printer. $149.95. Paperback Software International, 415/644-2116.

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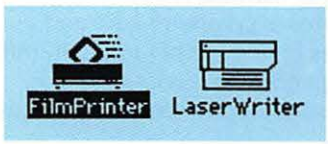
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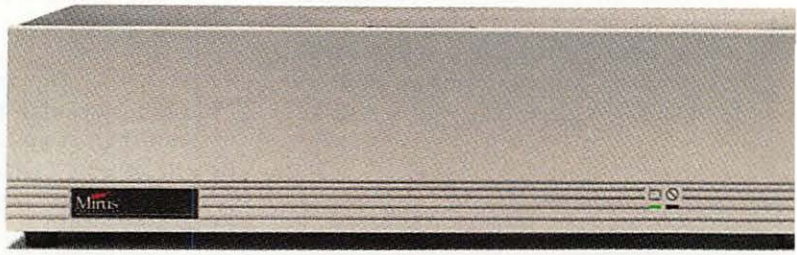
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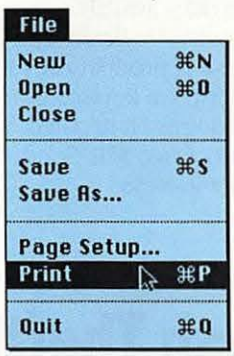
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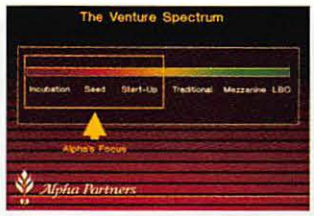
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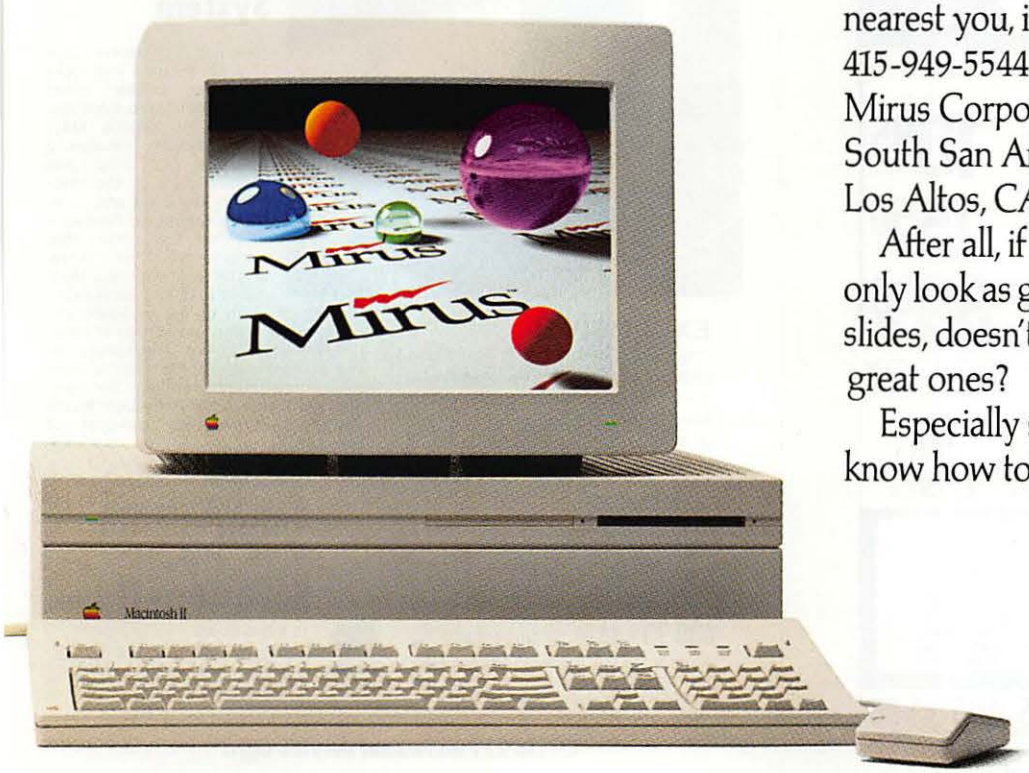
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IPT 1000 Allows a user to network the Mac SE with any machine that has either an Internet Protocol or Ethertalk device driver. Operates with several different TCP/IP products currently available as well as Ethertalk. Supports AFP file servers. Provides Mac-to-Unix networking. $495. Information Presentation Technologies, Inc., 818/347-7791.

Lapcad Finite Element Modeler Creates finite-element models for use in MacNeal-Schwendler Corporation's MSC/pal. 1MB min. memory. $295. Lapcad Engineering, 619/421-1236.

LaserThai Series of six PostScript Thai fonts includes styles ranging from modern to classical. Compatible with all current Mac software. Offers all consonants, vowels, and tone markers with accompanying bitmapped fonts. Includes Thai Key Caps. $149.95. Linguists' Software, 206/775-1130.

Lunar Rescue Combines graphic animation, unique game features, and arcade-style sound effects with an imaginative scenario in which the player searches for stolen crystals, coordinates transport supplies, and buys and sells commodities. 512KE min. memory. $49.95. PCAI, 612/427-4789.

MacBlast Communications package comes with standard terminal emulation, including DEC VT100/VT200 and Data General D200. Supports MultiFinder for background file transfers. Includes auto-dialing and auto–log in to remote computers, automated modem support, and scripting. 1MB min. memory. $195. Communications Research Group, 504/923-0888.

MacGallery Clip art collection of more than 400 original images covers topics such as holidays, sports, food, special occasions, nature, fantasy, religion, phrases, teddy bears, mortise cuts, and borders. Available as HyperCard stackware or as MacPaint files. Includes reference guide. $49.95 plus $2 s/h. Dream Maker Software, 213/221-6436.

Mac Personal Class Stackware for personal information organization in areas such as family records and investment and insurance data. Features automatic installation on your home card, self registration, and detailed online help screens. 1MB min. memory. $59 plus $3.50 s/h. Quadmation, Inc., 408/985-8984.

MacYacc Program capable of automatically generating C or Pascal source code for building assemblers, compilers, calculators, typesetting languages, language translators, and pattern analyzers. Generated code can then be compiled to produce the final product. Run-time library and example sources provided. 1MB min. memory. Personal version $139, professional version $395. Abraxas Software, 503/244-5253.

Milo Mathematical problem solver combines WYSIWYG technical word processor, symbolic algebra program, and graphics tool. 512K min. memory. $250. Paracomp, 415/543-3848.

The Movie Stack HyperCard stackware features over 4100 movie titles available on video or laser disc. Movies are listed with title, stars, director, year of production, rating, category, and descriptive keywords. 1MB min. memory; requires HyperCard. Movie Stack $39.95; set of two $70. Southeastern Software, 504/246-8438.

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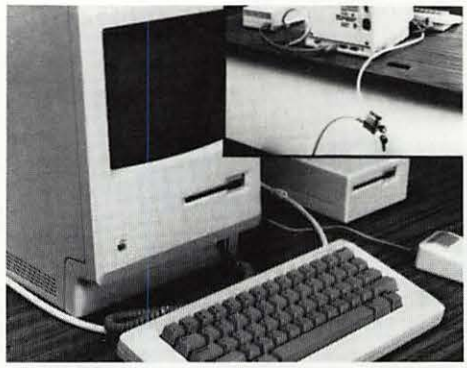
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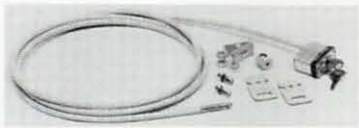


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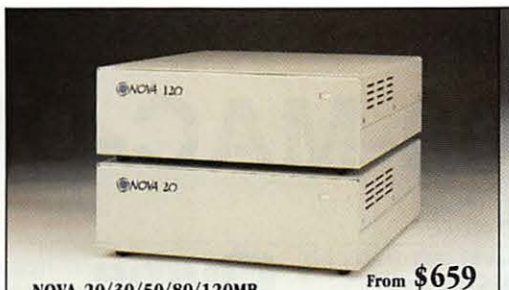
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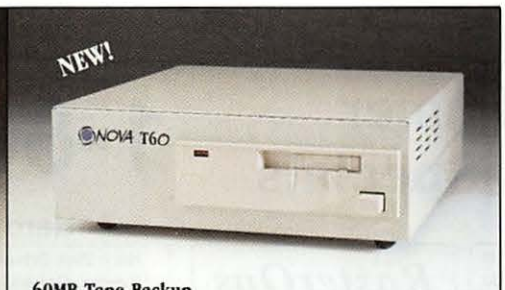
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PC MacTerm Works with pcAnywhere III to let users run a PC from a Mac, through a modem or direct cable connection or on a LocalTalk network. Requires System version 4.1 or later. $99. DMA, 212/687-7115.

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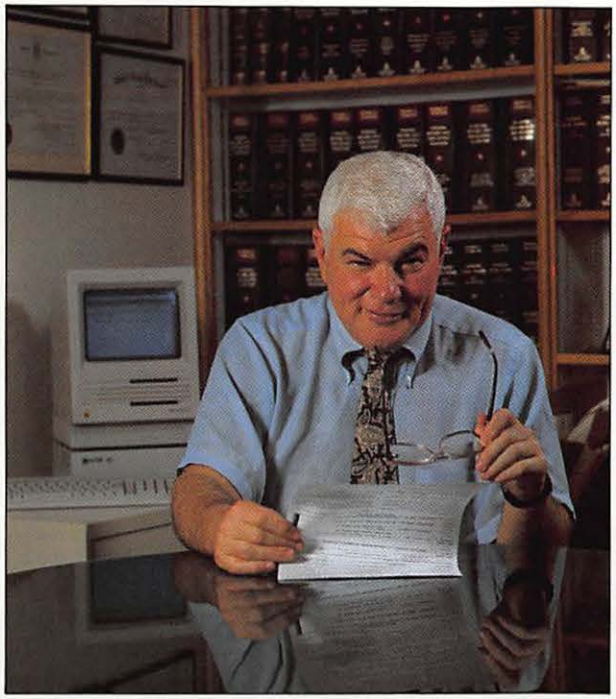
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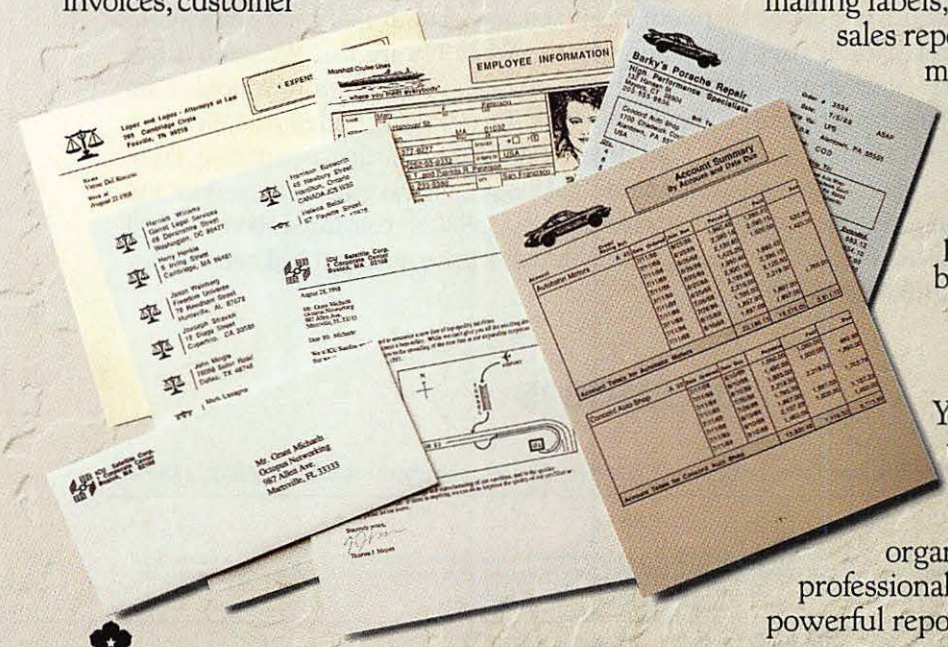
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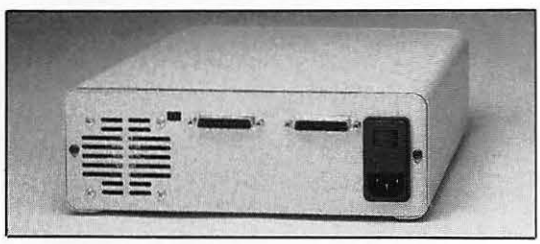
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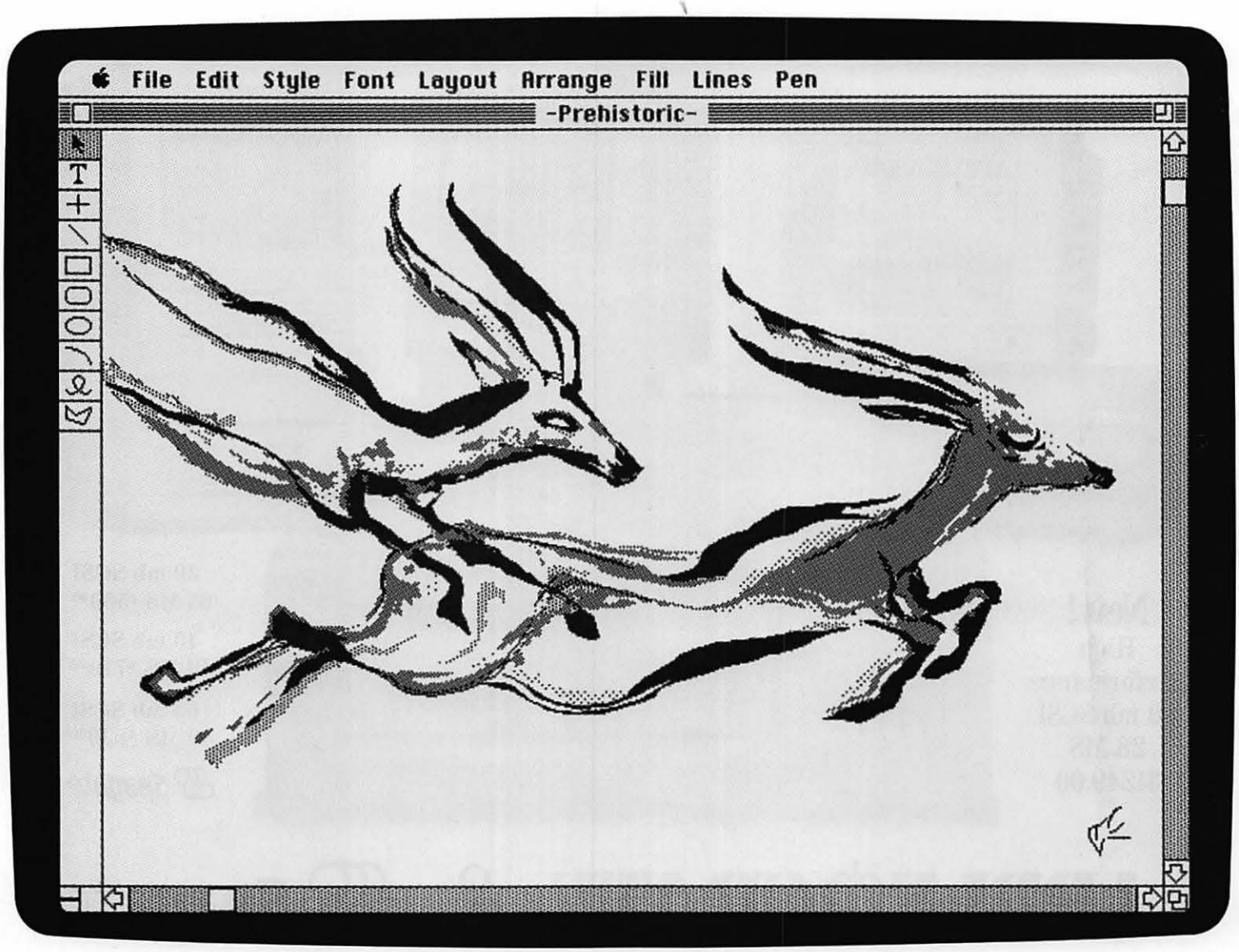
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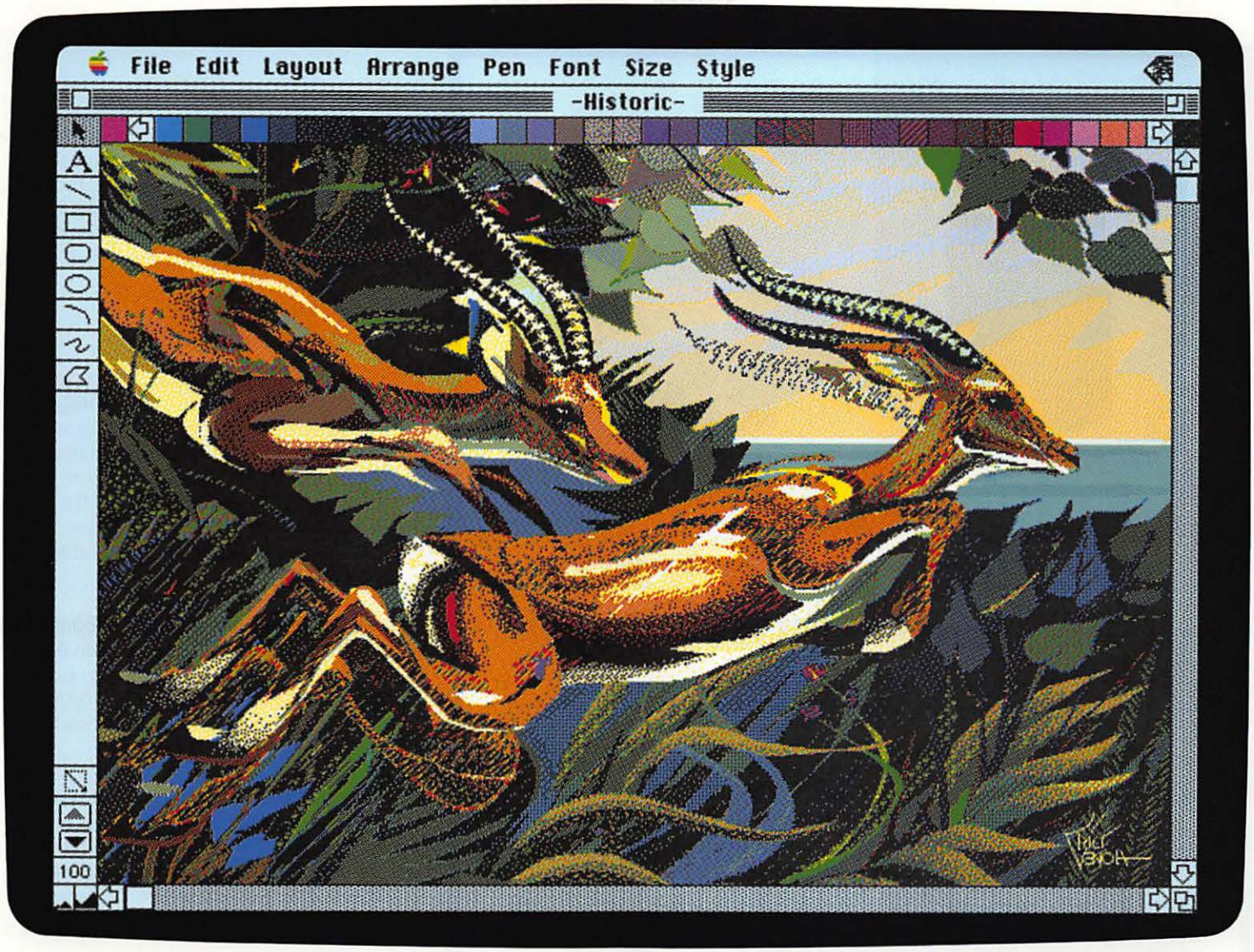
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New Products

Toppan Scan-Note System Mac II used in conjunction with a piano keyboard terminal for input and a PostScript output device for proofing. Compatible with Yamaha DX-21, DX-27, DX-100. 5MB min. memory; requires 40MB hard disk. £25,000. Toppan Printing Co., Ltd., 11 Grosvenor Gardens, London SW1 W OBD, England, 01 828 7292.

ACCESSORIES

Comp-U-Lock One Plus (no drill) CL1PN Single-lock system requires no drilling or other modifications to equipment for installation. Mastic-coated steel plate attaches to underside of the machine to secure to a mastic plate on the desktop. $48.95; two-lock system $89.95. Versa Lock, Inc., 800/248-5625, 800/642-5625 in California, 818/886-8962.

Mac Cozy Computer covers in loud Hawaiian Hula or Leopard print; 100 percent cotton lining. $10 to $45 depending on configuration. *The Chicken Boy Catalog for a Perfect World* available. Future Studio, 213/660-0620.

Macintosh Upgrade Book Contains information about various Mac configurations and tips on attaining desired performance. Describes good and bad points of various features found in upgrades. 52 pages. $2.95. Computer Quick, 213/941-7951.

Pro-Tech Laser Labels Self-adhesive, white or clear labels withstand high temperatures of laser printers. 2⅝ by 1 inch, formatted three across and ten down on 8½-by-11-inch sheets. Packages of 25 or 100 sheets. $10.95 to $174.95 depending on quantity and type. James River Corporation, 603/636-1154.

STAX Lockable and stackable disk storage units come with 5 color-coded dividers for indexing. $29.95. T. S. Microtech, Inc., 213/644-0859. □

To have your product considered for inclusion in New Products, *send an announcement with product name, description, minimum memory, peripherals required, pricing, company name, and phone number to New Products Editor,* Macworld, *501 Second St., San Francisco, CA 94107. We reserve the right to edit press releases.*

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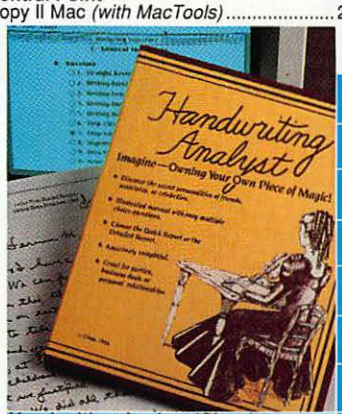
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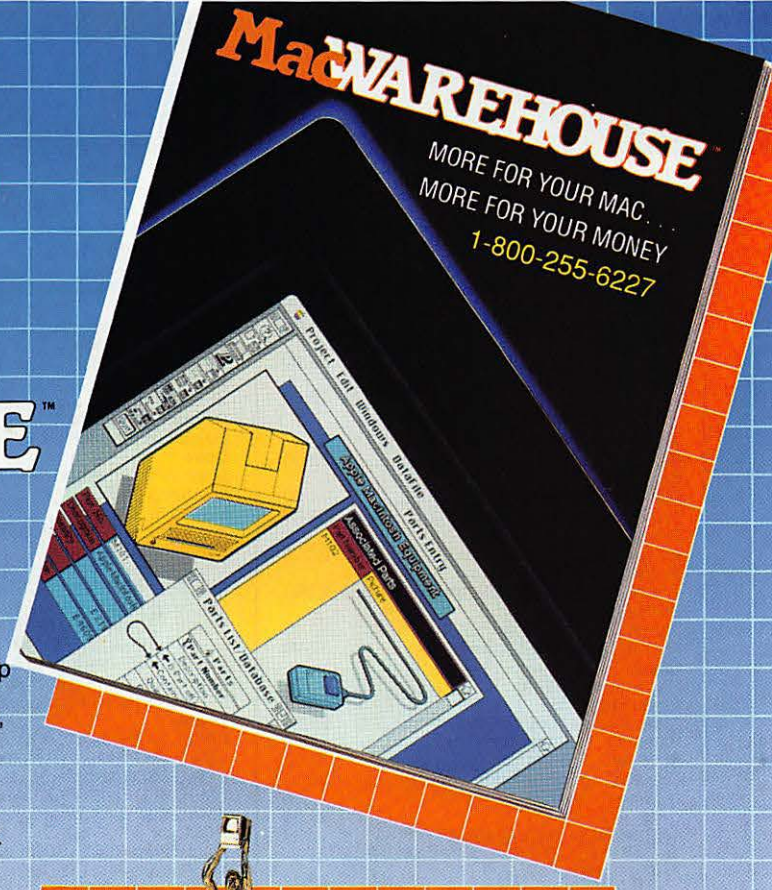
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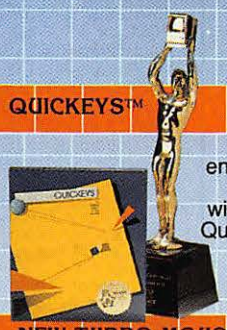
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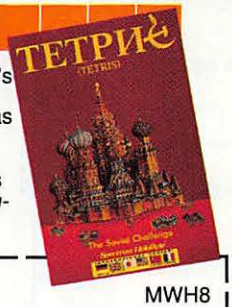
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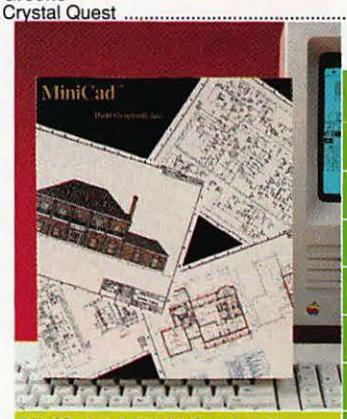
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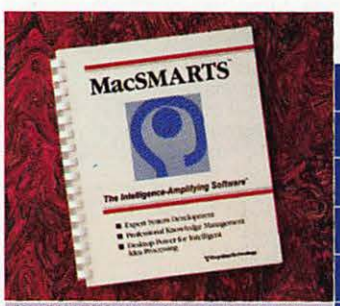
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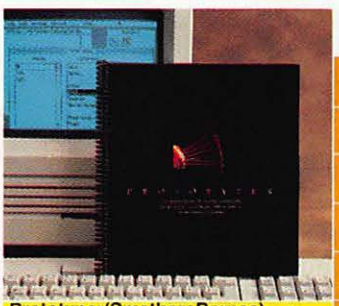


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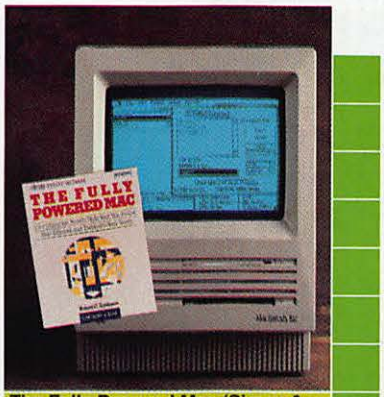
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"What's wrong with copying software?"

"I use a lot of programs on my personal computer, and I copy them all the time."

"I'm a programmer. Every time you copy one of my programs, you're taking away my income—I depend on *sold* programs for a living."

"Oh, come on. I bought it: I have a right to copy it."

"You *do* have a right to make a back-up, that's true. But when you start copying programs for your friends and co-workers, that's breaking the law."

"What law? Any copying I do is in the privacy of my own home."

"It doesn't make any difference where you do it. Every time you copy a program without permission from the publisher, you're committing a federal offense."

"That's all right, I won't get caught."

"You're missing the point. The issue isn't "What can I get away with?"—it's "who am I hurting?"

Remember, lots of people worked hard to produce every program you use: designers, programmers, distributors, retailers, not to mention all the people who support users. They have a *right* to be compensated for their efforts, and their major compensation is through software sales."

"Well, I don't mean to hurt all those people—or anyone, really."

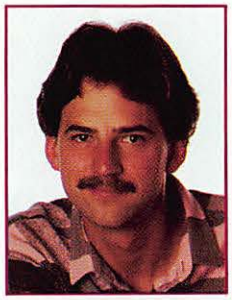
"Unfortunately, that's what copying does: it hurts people. And, ultimately, it hurts people like you, who want new and innovative software."

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Quick Tips

Answers to your questions

by Lon Poole

As I mentioned in a previous column (April 1988), you can prefix folder and document names with spaces or symbols to determine where the names appear in the Open dialog box or the Finder's By Name view. But Andy Hong of Menlo Park, California, notes that the Finder won't let you simply insert a space in front of a name. To fool the Finder, you must type a nonspace character followed by a space. Then delete the nonspace character—for example, by pressing the Left Arrow key followed by the Backspace (or Delete) key.

Stack Fonts II

In response to a tip in an earlier issue, I said that you could use Font/DA Mover to move fonts into HyperCard stacks. But Bruce Long, who submitted the tip, points out that Font/DA Mover cannot install fonts in stacks or other documents that have no resources. If you try, the utility informs you that the file you're trying to open may be damaged or in use. Because most stacks have no resources, Long suggests using ResEdit to copy fonts into stacks.

Q Object Self-Reference

How do I get a HyperCard button to refer to itself? The following script doesn't work:

```
on mouseUp
  get the name of this button
  go stack it
end mouseUp
```

Brad Knowles
Norman, Oklahoma

A You can't identify a button using the word *this*. Instead, use the Target function, which identifies the object that first received the current message. You can also use the special object Me, which identifies the owner of the current handler. Try either of these scripts:

```
on mouseUp
  go stack short name of the target
end mouseUp
```

or

```
mouseUp
  go stack short name of me
end mouseUp
```

Q Enormous Word Documents

While trying out Microsoft Word 3.0 at my local dealer, I decided to find out how many pages Word could handle. So I wrote a sentence, copied it, and pasted it many times. When I tried to save this document on an 800K disk, an alert box said, "Not enough space on disk to save work." In the lower-left corner of the Word window was the cryptic message, "5331201 Cha." My dealer couldn't explain it; can you?

Stefan Johansson
Malmo, Sweden

A Although theoretically there's no limit to Word document size, practical limits intrude when a document gets very large. You discovered one such limit, namely that the whole document must fit in the space available on a disk. The document you created would have been over 5000K. An empty 800K disk has space for slightly less than one-sixth of that. You might have been able to save your mammoth document on a hard disk, although saving 5000K would have taken ages. I've found Word documents over about 200K aren't worth the wait. Word lets you split a long document into manageable pieces and link the pieces together with a special feature of the Page Setup command (described in the Word manual under "Long Documents").

You might think your 5-megabyte document would be too big for your Mac's 1MB memory. Word uses "mirrors" to let you paste together a document larger than the available memory. What you see on screen are reflections of the original text. However, Word doesn't save reflections on disk. It needs space to store real text.

Q Text Style Changes in Bulk

Is there a way to change text style throughout a document using one command in a word processor such as Microsoft Word, MacWrite, or WriteNow? The grant and research proposals we write at North Texas State University require italicized scientific terms that may each appear as many as 50 times in a 300-page paper.

John F. Vickrey
Denton, Texas

A A word processor with style sheets at the character level would make your task easy. However, no currently available Mac word processor has them. Word 3 for the Mac has style sheets at the paragraph level only (the IBM PC version of Word has had character-level style sheets for years—growl). New word processors such as FullWrite Professional, WordPerfect, and the next version of Word may include character style sheets.

In the meantime, you can change the text attributes of a specific word or phrase throughout a Word 3 document using the Change command from the Search menu. First, find an instance of the text you want changed and give it the attributes you want it to have. Select and copy that text to the Clipboard. Click at the beginning of the document and choose the Change command. Type the text you want to find in the Find What box, and type ^c (lowercase *c*) in the Change To box. This tells Word to replace each instance of the original text with the contents of the Clipboard.

(continues)

Lon Poole answers readers' questions and offers advice in his monthly Macworld *column. Many of the tips he's compiled can be found in his book* Mac Insights *(Microsoft Press, 1987).*

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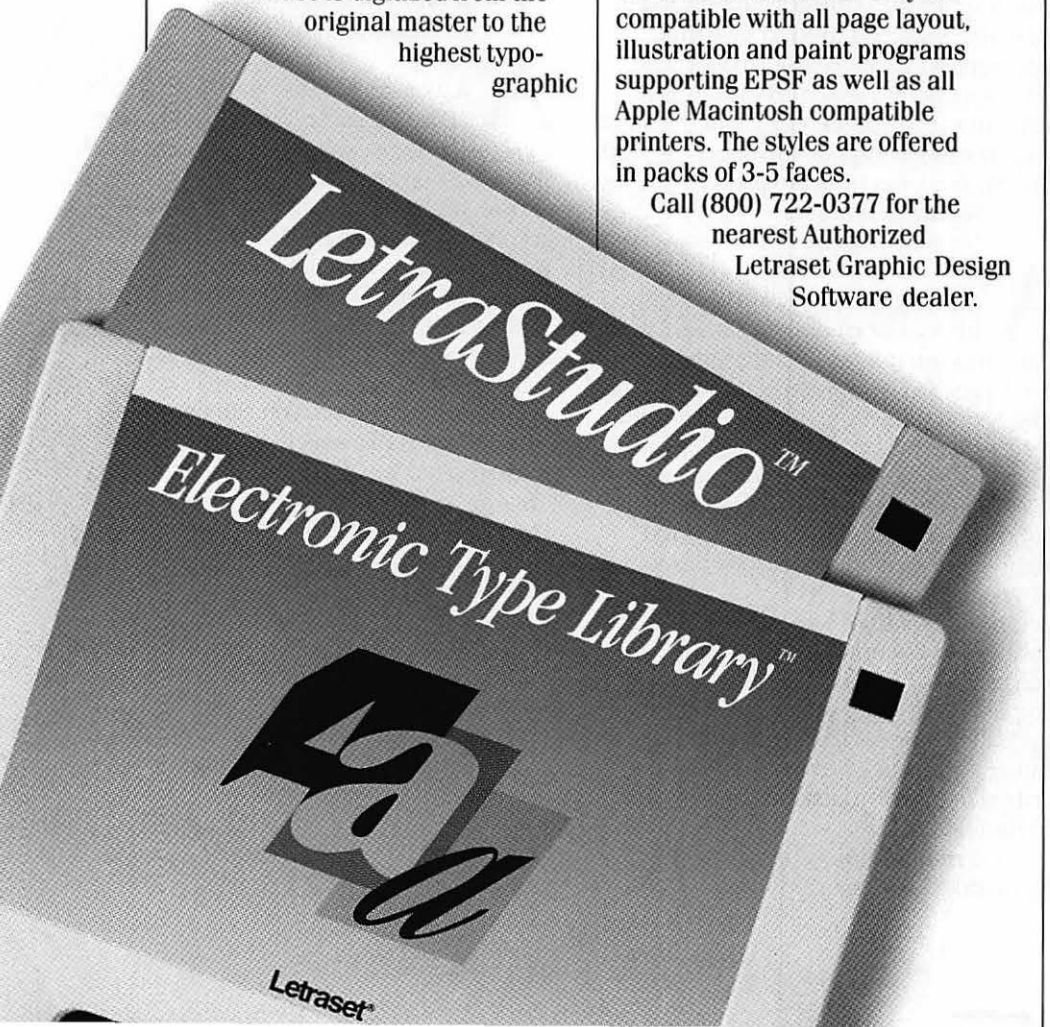
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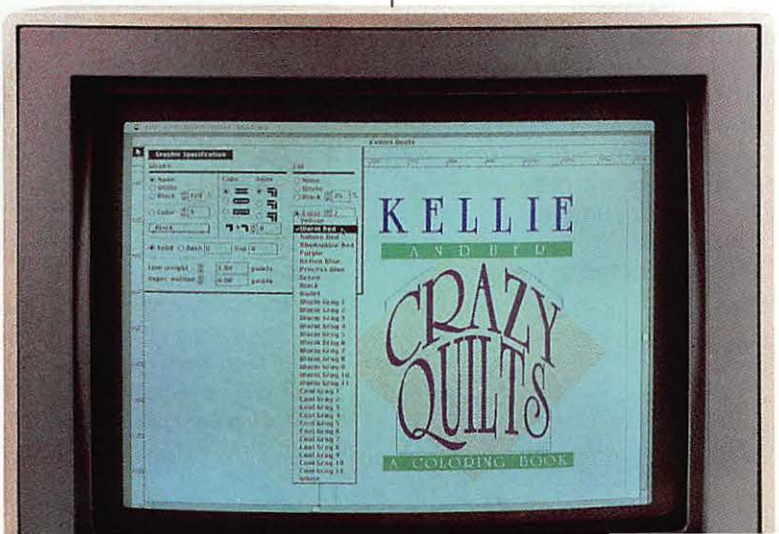
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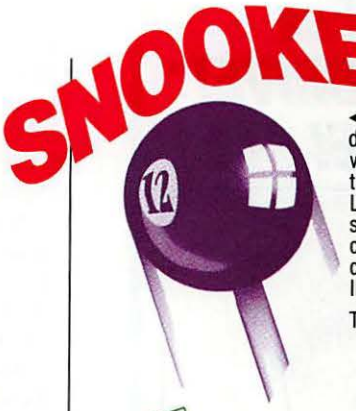
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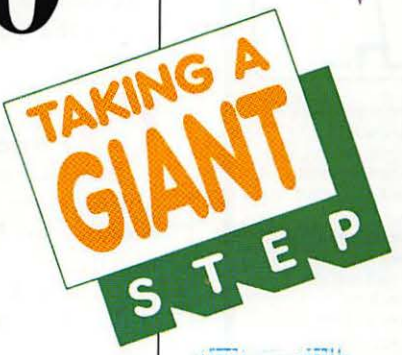
Type: Letraset University Roman Bold





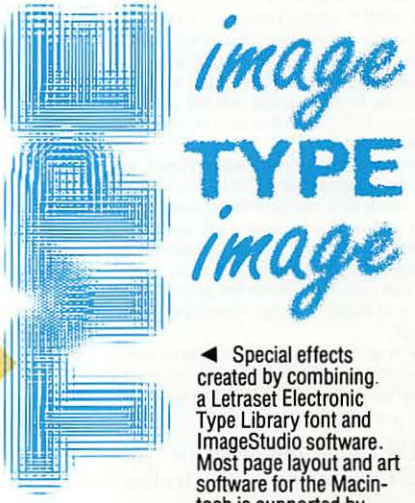
◄ An extra dimension was added to the type with LetraStudio software and combined with art created on Adobe Illustrator '88.

Type: Helvetica



◄ Spot art is easy to create –the box shapes were produced in LetraStudio software and then the type was stretched while in position.

Type: Letraset Frankfurter



◄ Special effects created by combining a Letraset Electronic Type Library font and ImageStudio software. Most page layout and art software for the Macintosh is supported by LetraStudio software.

Type: Helvetica & Freestyle Script



◄ The character of a beautiful letter is enhanced by selecting one of the many optical distortions available.

Type: Letraset Algerian

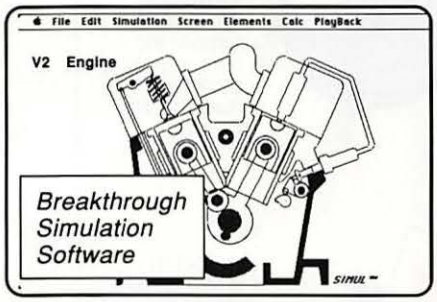
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Word notes how the Clipboard text deviates from the normal character format of the paragraph from which it came, and applies the same deviations to the normal character format of each instance of the text to be found. This method works best if all the text being changed appears in paragraphs that have similar character formats. Applying a character style to text within a paragraph that's already in that character style will cancel out your style selection. For example, if you change a word to italic in a paragraph whose normal style is italic, the word will be in plain text rather than italics in that paragraph. For another method, see the Rich Text tip below.

Q Those Memory Leftovers

After upgrading my Mac SE's memory from 1MB to 2.5MB, the dealer gave me back the two 256K SIMMs. What can I do with them?

Eric R. Krebs
San Francisco, California

A Save your leftover SIMMs for a holiday cheese ball. They can't be used in a Mac Plus or an SE because of those machines' memory configuration requirements (see "Installing Memory," May 1988). Four 256K SIMMs (but not just two) can be added to a 1MB or 4MB Mac II, but a Mac II requires 120-nanosecond memory—and memory from an SE or a Plus is usually rated at 150 nanoseconds. The slower memory may work in a II, but then again it may not. Perhaps the two 256K SIMMs in your Mac will die and you can replace them with the extras.

Q Editing Landscape Pictures

We use Adobe Illustrator to create most of our company's graphics. To get templates, we scan artwork using a Microtek 300A at 72 dots per inch. Some of the artwork is horizontally oriented. Because we must scan it vertically, we need to rotate it in a MacPaint-type program before using it in Illustrator. We can do the rotation in MacDraw, but we can't edit the scanned image there. Are there any paint programs that handle wide documents?

Mike Penn
Pittsburgh, Pennsylvania

A *Macworld* contributing editor and resident graphics specialist Erfert Fenton says Canvas ($195 from Deneba Software, 800/622-6827 or 305/594-6965 in Florida) can do what you want. Before pasting the scanned image, use Canvas's Page Setup command to select Landscape Orientation. After pasting, use the Rotate 90° command from the Effects menu to turn the scanned image.

Control Panel Order

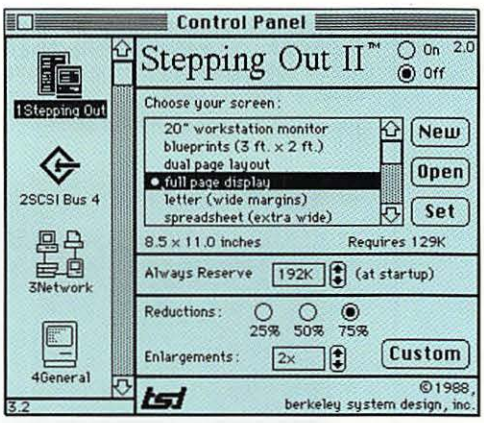
Tip: By renaming files in the System Folder that correspond to options and devices in the Control Panel—using System 4.1 or higher and Control Panel 3.1 or higher—you can easily rearrange them in any order that suits you. (Normally, General appears first, and all other items appear alphabetically after it.) Another method is to put numbers in front of the original names (see "Order Please"). To rename some files—including General, Color, Keyboard, Monitors, Mouse, Sound, and Startup Device—you have to duplicate them (use the Finder's Duplicate command), rename the copy, and throw away the original.

Paul R. Pudaite
Urbana, Illinois

Rich Text

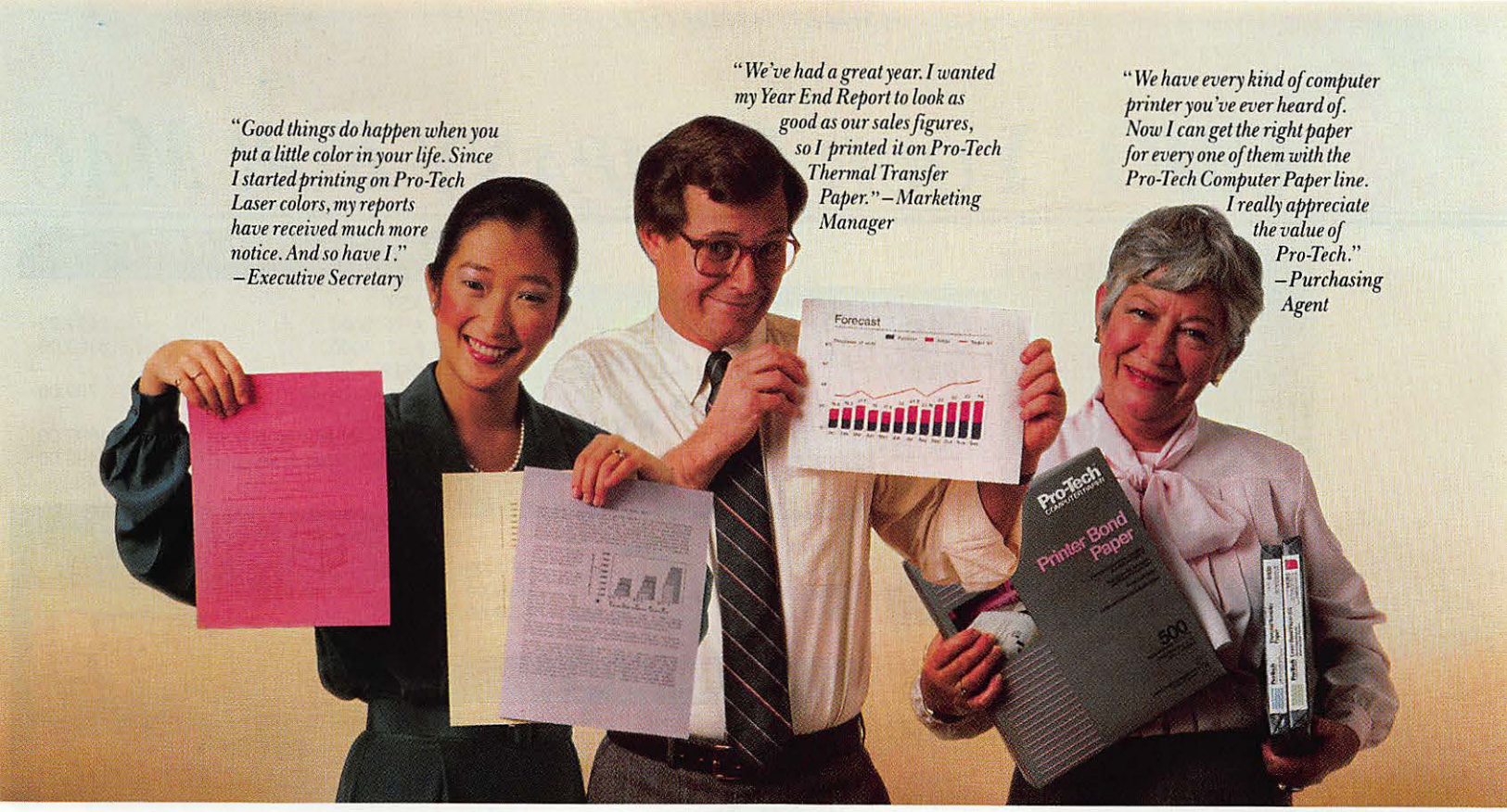
Tip: Word 3's ability to save a document in Rich Text Format, which it calls Interchange (RTF), does far more than facilitate communication between computers. It also lets you easily change text attributes (font, size, and style) and make other formatting changes throughout the document.

(continues)



Order Please

By renaming (or numbering) the appropriate files in the System Folder, you can change the order of the options and devices listed in the Control Panel. Here, Stepping Out II, a screen extender, has been placed at the top of the list.



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To convert a document to RTF, use Word's Save As command. In the Save As dialog box, click the File Format button and then select the Interchange (RTF) option. Enter a new document name and click the Save button. You'll then get a new plain-text document with mnemonic codes for every format. For example, the three characters *\ul* indicate underline style. You can replace one format with another using Word's Change command (changing *\ul* to *\i* converts underline to italics).

When you finish changing formats, save the document and close it. Then open it again, answering *Yes* when Word asks whether it should interpret RTF codes. A little while later, you'll see your document with the formatting changes.

Jan Bruyndonckx
Hove, Belgium

Changing styles and sizes of individual words is easy if you know the RTF codes (see "RTF Character Formats"). Changing fonts of individual words is more complicated. RTF encodes fonts by number and correlates fonts and RTF font numbers in a font table at the beginning of the document. If you want to change to a font that's not listed in the font table, temporarily add some text in that font to the regular, non-RTF version of the document and then resave it as an RTF document. Immediately following the font table, RTF encodes all the document's style sheets. You shouldn't need to change any of them in the RTF version. Instead, make the changes in the non-RTF version using the Define Styles command.

Note: During the conversion to and from RTF, Word may lose tab settings you've put in paragraphs' formatting rulers. It doesn't seem to lose tab settings in style sheets, however.

For complete RTF documentation, call Microsoft Customer Service at 206/882-8088 or write to Microsoft Corp., RTF Applications, Box 97017, Redmond, WA 98073-9717.

MultiFinder Compatibility

Tip: A few applications don't work properly with MultiFinder. To avoid accidentally opening an incompatible one, set its application memory size to a number larger than the amount of memory on your Mac, such as 9999. This prevents you from launching the application with MultiFinder active but still allows you to open it when MultiFinder is inactive. To change the application memory size, make sure MultiFinder is active, select the application icon, and choose Get Info from the Finder's File menu.

Christopher Eliot
Leeds, Massachusetts

Multifaceted Excel Macros

Tip: By combining multiple Excel command macros, you can run them in rotation with the same Option-⌘-character key combination. As a simple example, one macro can cyclically change the alignment of the current worksheet selection (see "Schizoid Macro"). Each time you run the macro, it changes to the next alignment in its cycle: left, center, right, and repeat.

Calvin Walker
Potts Point, NSW, Australia

	A
1	ALIGNMENT
2	left
3	=IF(cycle=0,ALIGNMENT(2),GOTO(center))
4	=SET.VALUE(cycle,cycle+1)
5	=RETURN()
6	center
7	=IF(cycle=1,ALIGNMENT(3),GOTO(right))
8	=SET.VALUE(cycle,cycle+1)
9	=RETURN()
10	right
11	=ALIGNMENT(4)
12	=SET.VALUE(cycle,0)
13	=RETURN()
14	cycle
15	0

Schizoid Macro
Each time you run this Excel macro, it changes the worksheet selection to the next alignment in this cycle: left, center, right, and repeat. Cell A15 in the macro keeps track of the cycle. You must name cell A3 "left," A7 "center," and A11 "right."

SuperPaint Line Length

Tip: If you need to shorten or lengthen several lines in SuperPaint's drawing layer, select them all and choose Scale Selection from the Edit menu. Select or enter the amount of scaling needed (for example, scaling by 200 percent doubles the line lengths). Then click OK.

Richard C. Johnson
Baton Rouge, Louisiana

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Code	Format
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\b	Bold*
\i	Italic*
\strike	Strikethru*
\outl	Outline*
\shad	Shadow*
\scaps	Small caps*
\caps	All caps*
\v	Hidden*
\fx	Font number *x***
\fsx	Font size *x* half-points
\expndx	Expand or Compress *x* quarter-points (negative *x* compresses)
\ul	Underline*
\ulw	Word underline*
\uld	Dotted underline*
\uldb	Double underline*
\ulnone	Cancel all underlining
\upx	Superscript *x* half-points
\dnx	Subscript *x* half-points

*Can be turned off by repeating the format code with a suffix of zero (0).
**A font table at the beginning of the document correlates fonts and font numbers.

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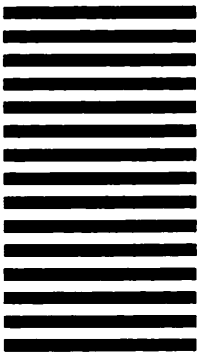
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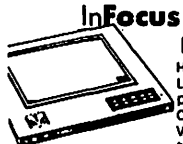
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Getting Started with CAD

CAD programs are making life easier for engineers, designers, and architects. Here's how.

by Jim Heid



MICK WIGGINS

This is not a good time to be in the T-square manufacturing business. Computers are replacing traditional drafting tools in the same way that word processors are supplanting typewriters. *Computer-aided-design* (CAD) programs can turn computers into electronic drafting tables that make it easier than ever to create and revise complex drawings.

CAD was born in the sixties, when some automobile and aircraft manufacturers began using mainframe computers and large graphics terminals to design such complex beasts as cars, planes, and missiles. Since these computer systems cost millions of dollars to buy, and hundreds of dollars an hour to run, CAD's benefits were reserved for the few who could afford them.

As the cost of computers shrank and their capabilities grew, CAD became feasible for smaller firms. Shortly after microcomputers debuted, CAD appeared on desktops, though the Mac, despite its superior graphics, wasn't part of the picture. Using the Mac's 9-inch screen to view blueprint-size CAD drawings would be like viewing the ceiling of the Sistine Chapel through a keyhole. But now with big screens available for nearly every model of Mac, and more important, with the Mac II's increased speed, the Mac is becoming a force in microcomputer CAD.

What is CAD? To answer that question, I had to get started with CAD myself. My guide was David Peltz, a fellow *Macworld* contributing editor who operates CADventures, a CAD consulting firm in Chatsworth, California. (For more details on Mac CAD software, see Peltz's feature "2-D CAD: A Landscape View," *Macworld,* July 1988.)

It's Object Oriented

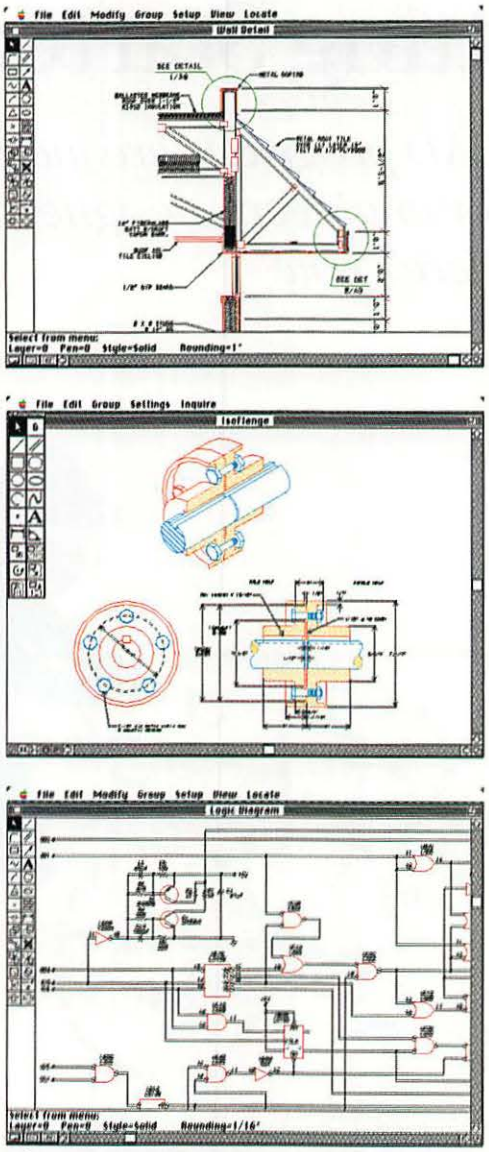
At its foundation, CAD is *object-oriented* drawing, a system that stores drawings as a series of individual objects —circles, boxes, arcs, lines, and so on— that can be easily resized and otherwise altered. The other common form of Mac drawing is *bitmapped* drawing—MacPaint-style drawing, where images are stored as a series of on and off bits corresponding to the black and white pixels on the screen (see "Getting Started with Macintosh Graphics," *Macworld,* August 1987).

CAD's three basic drawing categories are mechanical, architectural, and electrical engineering (see "Three Faces of CAD"). Mechanical CAD is the broadest category. It involves the design of objects: cars, planes, trains, machine parts, lamp shades, thumbtacks—you name it. Most mechanical CAD programs create two-dimensional drawings; only a few can create three-dimensional drawings (see "CAD Variations").

Architectural CAD, as you'd guess, involves the design of buildings. Architects create many kinds of drawings: *elevations* depicting a building's profile; floor plans showing room dimensions, door locations, and furnishings; and maps of a building's plumbing, heating, and electrical systems. Many CAD programs provide drawing tools for creating parallel lines, making it easy to draw walls. Some architectural CAD programs let you create a 3-D view that you can rotate and examine from different angles.

(continues)

Jim Heid is a contributing editor of Macworld. *He has been writing about the Macintosh since its introduction and is the author of* dBase Mac in Business *(Ashton-Tate Publishing, 1987).*



Three Faces of CAD

Examples of the three primary CAD types: an architectural drawing created in PEGASYS (top), a mechanical drawing created in VersaCAD (middle), a schematic diagram created in PEGASYS (bottom).

Electrical engineers use CAD programs to design circuits and *schematics*—those symbols and lines that show how electronic components interconnect. Special CAD programs called *schematic capture* programs work behind the scenes to keep track of what's connected to what. When you're finished, you have not only a schematic drawing, but also a list of connections that can be used to map out the routes of the copper highways and byways that traverse a printed-circuit board.

At this advanced level, CAD programs play a direct role in executing a design. Many programs can shuttle their data directly into *computer-aided manufacturing* (CAM) equipment, which uses measurements and specifications in the CAD drawing to control industrial robots or machining tools to create the parts from the drawing. Such Buck Rodgers CAD/CAM is primarily the province of six-figure workstations, but the Mac is making inroads. At a CAD/CAM trade show, a Roland machining mill—connected to a Mac II running MGMStation CAD/CAM—machined an automobile piston rod out of a block of wax, based on a drawing created with VersaCAD.

Life with a CAD

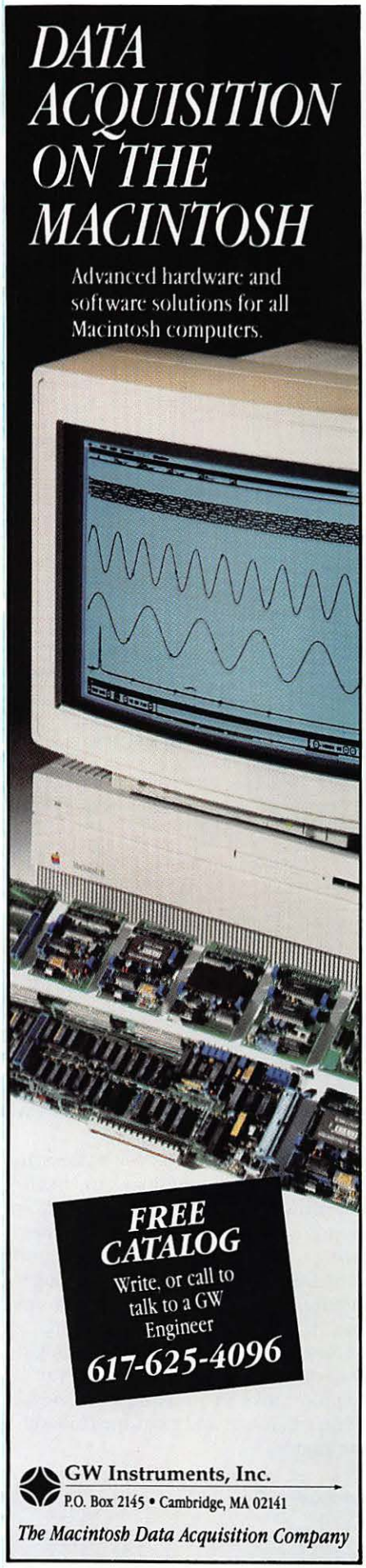
If you suspect software with this kind of power is complex, you're right. Forget diving into a CAD program without opening the manual. You'll need days or weeks of practice to master the hundreds of drawing, measuring, and annotating features that a powerhouse CAD program provides.

If you've used Apple's MacDraw, you have a head start. From the features standpoint, MacDraw is to a CAD program what a tricycle is to a Harley-Davidson, but there are similarities in their basic approaches to electronic drafting. You begin with a blank, untitled document window, and create a drawing by choosing tools from on-screen palettes, using the mouse to draw shapes. (Many CAD devotees shun the mouse in favor of a *graphics tablet*—a flat surface on which you scrawl with a *stylus*. A stylus and tablet feel more like a pen on paper, and they provide greater precision than a mouse.)

To help you draw straight lines and position objects accurately, MacDraw and CAD programs provide a *snap-to* feature that causes the mouse pointer to be drawn to an invisible grid as it moves. But CAD programs offer more ways to snap. For example, most programs let you specify that an object snap to a particular point on another object, or to the point where two objects intersect.

MacDraw provides tools for drawing several different shapes, but a CAD program's palettes bristle with specialized tools that make creating complex drawings easier. *Geometric facilities* replace compasses and protractors and allow you to quickly draw objects requiring calculations or measurements. Need to measure an angle or calculate the midpoint of a line? Want to draw a line perpendicular to a

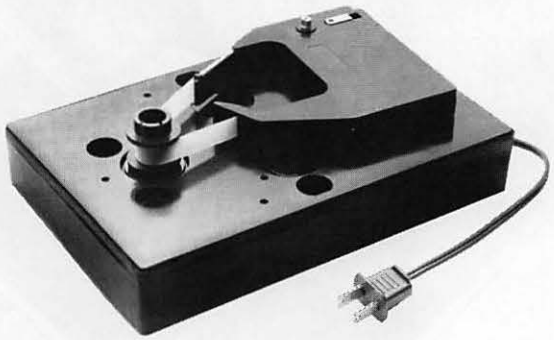
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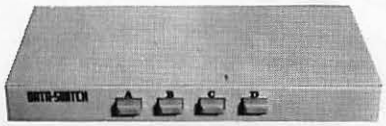
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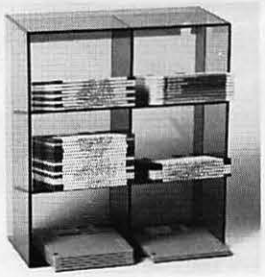
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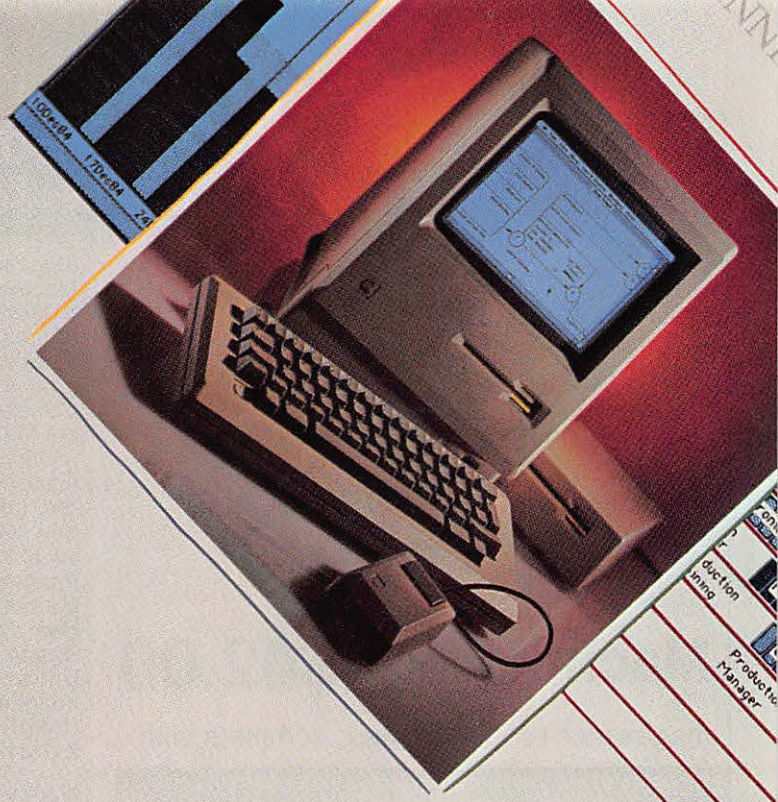
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- ☐ 15. Research and development
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- ☐ 98. Other (specify) _____

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- ☐ 19. Computer retail
- ☐ 20. Distributor/wholesaler
- ☐ 21. Manufacturer (computers, software, peripherals)
- ☐ 22. Service bureau
- ☐ 23. VAR/systems house/integrator
- ☐ 99. Other (specify) _____

2. Title (check only one)

- ☐ A. Chairman/president/owner/partner
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- ☐ C. Controller/treasurer/accountant
- ☐ D. Director/supervisor/manager
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- ☐ F. Art director/writer/chief/group leader
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- ☐ K. Programmer
- ☐ L. Educator
- ☐ M. Professional (lawyer, doctor, etc.)
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4a. Does your company own or lease any mainframe computers at this location?

☐ **Yes** (indicate quantity below) ☐ **No**

	Existing (quantity)	Plan to buy (quantity)
☐ 1. IBM		
☐ 99. Other (specify)		

4b. Does your company own or lease any minicomputers at this location?

☐ **Yes** (indicate quantity below) ☐ **No**

	Existing (quantity)	Plan to buy (quantity)
☐ 1. IBM		
☐ 2. DEC VAX		
☐ 3. Sun/Apollo		
☐ 99. Other (specify)		

5. Does your firm have or plan to buy any of the following types of personal computers or microcomputer systems at your location?

☐ **Yes** (indicate quantity below) ☐ **No**

	Currently own	Plan to buy within 1-12 mos.
1. Macintosh 128/512		
2. Macintosh Plus		
3. Macintosh SE		
4. Macintosh II		
5. IBM or compatible		
6. Sun/Apollo workstation		
99. Other (specify)		

USE NUMBERS ONLY

6. Please indicate your involvement with each of the following types of personal computers or microcomputer systems (check all that apply)

	Macintosh	Software	Networks & Peripherals
A. Approve purchase	A. ___	A. ___	A. ___
B. Develop/manufacture	B. ___	B. ___	B. ___
C. Evaluate/select vendor	C. ___	C. ___	C. ___
D. Own one	D. ___	D. ___	D. ___
E. Own two or more	E. ___	E. ___	E. ___
F. Purchase or acquire	F. ___	F. ___	F. ___
G. Establish specifications	G. ___	G. ___	G. ___
H. Recommend to others	H. ___	H. ___	H. ___
I. Sell	I. ___	I. ___	I. ___
J. Train people to use/ or provide support	J. ___	J. ___	J. ___
K. Use	K. ___	K. ___	K. ___
L. No involvement	L. ___	L. ___	L. ___
Z. Other (specify by name and quantity)	Z. ___	Z. ___	Z. ___

_____

If you have no involvement with any of the above, skip to question 8.

7. Do you recommend, buy, specify or approve microcomputers, software, and/or peripherals?

☐ **Yes** ☐ **No**

If yes, please indicate for how many Macintosh personal computers you have this involvement. (check only one)

- ☐ A. 1-3
- ☐ B. 4-9
- ☐ C. 10-19
- ☐ D. 20-49
- ☐ E. 50-99
- ☐ F. 100-499
- ☐ G. 500+
- ☐ H. None of the above

8. How many people are employed by your entire company? (check only one)

- ☐ A. 1-9
- ☐ B. 10-24
- ☐ C. 25-99
- ☐ D. 100-499
- ☐ E. 500-999
- ☐ F. 1000-2499
- ☐ G. 2500-4999
- ☐ H. 5000-9999
- ☐ I. 10,000 or more

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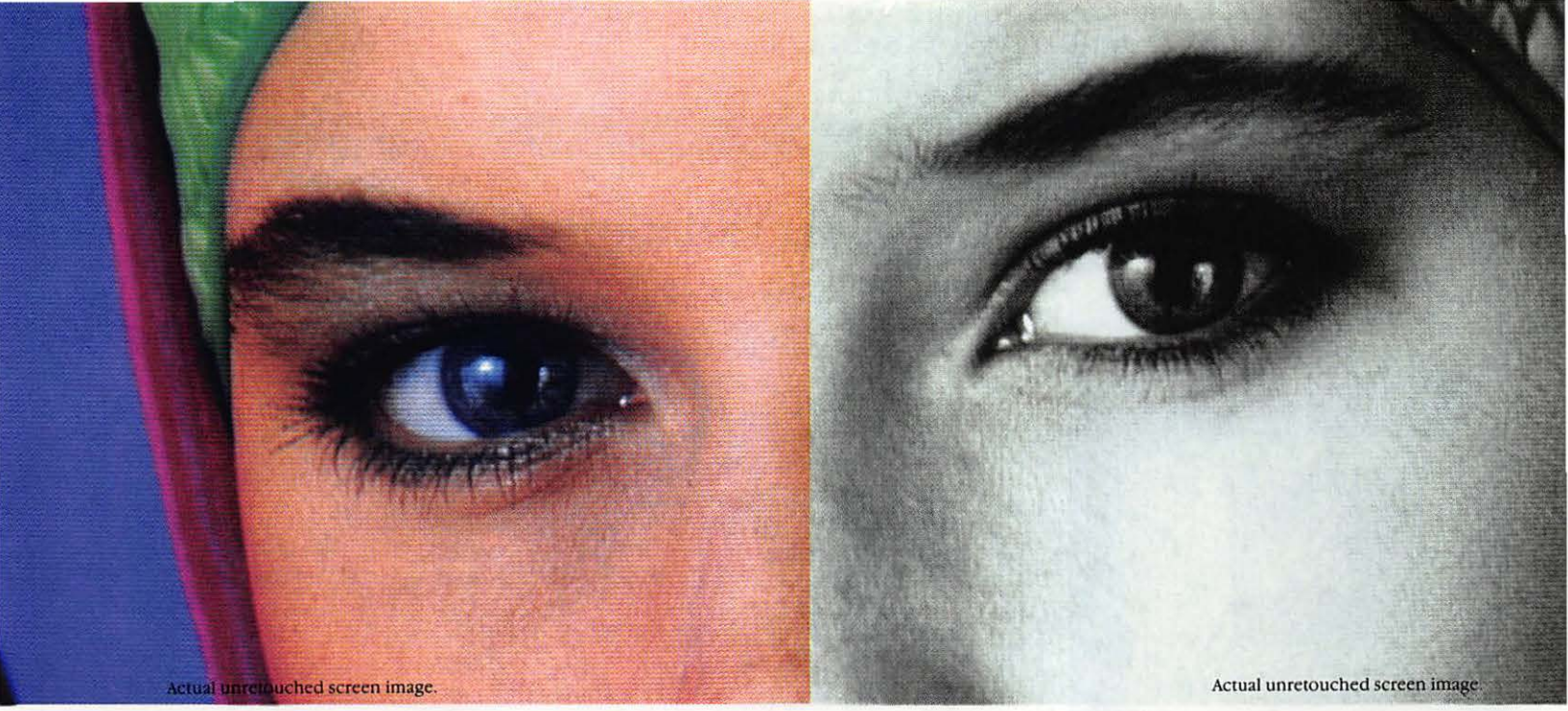
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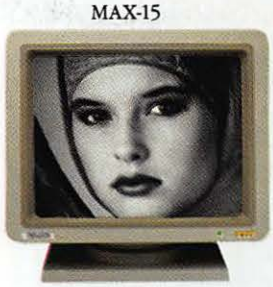
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CAD Variations

CAD doesn't always mean blueprints and schematics. Computers can aid the design process in other ways.

- *Three-dimensional modeling* Programs such as Silicon Beach Software's Super 3D, Enabling Technologies' Pro3D, Abvent's SpaceEdit, and Visual Information's Dimensions series let you create drawings that simulate 3-D objects (see "3-D, Take 2," *Macworld,* May 1987). One 2-D CAD program, MiniCad, also includes 3-D features. A 3-D program lets architects see their latest creations before they're built. Super 3D and SpaceEdit also provide animation.
- *Finite-element analysis* You've designed a bridge and want to know how it will endure rush-hour stress. If you know the steel's basic properties, you can use this CAD technique to divide the bridge's surface into a finite number of tiny sections called *elements,* then electronically apply stress to the elements and see how they fare.
- *Specialized CAD* Independent IBM PC developers have created AutoCAD *templates* for designing everything from kitchens to piping systems to oil wells. *Vertical-market* applications—ones tailored to specific professions—are just debuting now for Macs. Some will be template collections for general-purpose programs such as VersaCAD. Others, such as CompServeCo's $2250 Planit, a 3-D kitchen-design package, are designed from the disk up for specific trades.

slanted line? Or parallel to it? Or tangent to an arc (such as a belt connecting two pulleys)? Such chores are a common part of an engineer's or architect's life. A CAD program reduces them to a mouse click.

CAD programs also simplify altering the objects you draw. As with MacDraw, you can move or resize an object by selecting it and dragging the mouse. Some CAD programs also let you enter measurement or position values from the keyboard for greater precision. You can rotate objects in 1-degree increments (versus MacDraw's 90-degree increments), and you can create mirror images of objects. An architect could use a mirror-image feature to turn a left-hinged door into a right-hinged one. Most CAD programs also provide on-screen rulers and *coordinate windows* that display the mouse pointer's position as you work.

A more advanced level of object altering involves creating *chamfers* and *fillets.* A chamfer is a beveled corner formed by a diagonal line that connects two other lines. Chamfer all four corners of a box, and you get an octagonal shape similar to a stop sign. A fillet (pronounced *fill-it*) is similar, except the object connecting the two lines is an arc. If you fillet all four corners of a box, you get a box with round corners or, if the arcs are big enough, a circle.

Making It Easier

CAD programs also give you more ways to tame complex drawing jobs. One that nearly all CAD programs provide is a *layering feature.* Engineers and architects often assemble drawings using layers of transparent acetate, each showing a particular component or system. An architect might show a plumbing system on one layer, walls on another, electrical systems on a third, and room dimensions on a fourth. CAD layering features work similarly. You can move objects between layers and selectively show and hide layers, depending on how much detail you want to see. On a Mac II, you can usually assign a color to each layer to color-code parts of a drawing.

(continues)

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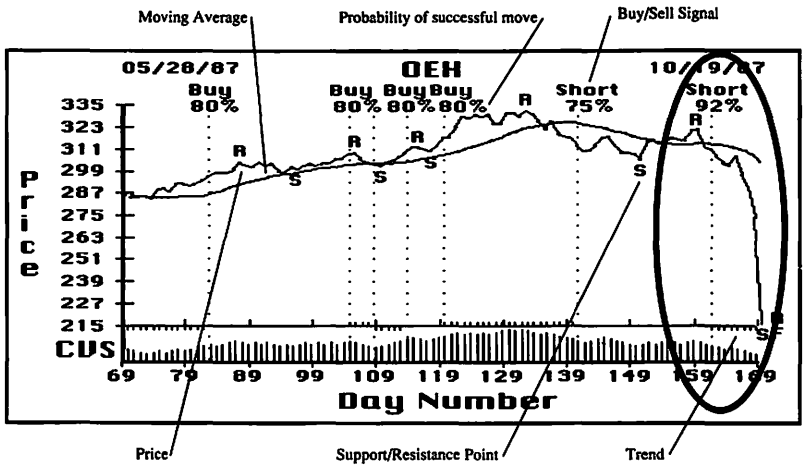
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Many CAD programs also let you open bit-mapped graphics and place them on one layer, then trace over them using the CAD program's tools. Innovative Data Design's Dreams, due out this summer, will allow you to create or change color patterns for both pen tools and objects (see "Dreams in Color").

Mechanical drawings and architectural blueprints always show the dimensions of their components. CAD programs provide *auto-dimensioning* features that label those dimensions for you. Simply choose a command or click a palette icon, select the item you're measuring, and the CAD program adds the dimension to the drawing, complete with arrows and *extension lines* (see "CAD Dimensions").

The kinds of objects you can measure vary between programs. Some programs, such as PowerDraw, provide only *linear* dimensioning—measuring the distance between two points. Others, including VersaCAD, MGMStation, and MiniCad, also support *angular* dimensioning—measuring the size of angles. MGMStation also offers *radial* dimensioning—the ability to measure the radii of circles.

Drawings and schematics often contain multiple copies of the same object, be it a bolt, a sink, or a transistor. Most CAD programs offer *symbol libraries* that make it easy to create, store, and reuse often-used symbols of your trade. Some programs come with libraries of common architectural or electronic symbols; with others, libraries are options that cost extra. With many programs, you can assign a name to each symbol, such as "3-inch carriage bolt" or "conference chair." ArchiCAD, an architectural CAD program, can use those names to print parts lists showing how many times a given component appears in a drawing. Other CAD programs will soon offer similar features, which are often called *attribute tracking* or *associativity*.

And because even a large-screen monitor can't show an entire blueprint-size drawing at actual size, all CAD programs offer *zoom* commands that let you move in for a close-up look or zoom out to get the big picture. But redrawing an image containing thousands of objects takes time, even on a Mac II. To eliminate the wait, most programs offer a *redraw halting* feature that lets you stop the redrawing process at any point. You can use redraw halting to stop further redrawing after the object you've zoomed in to see appears.

(continues)

How to Buy the Right Monitor.

Let's cut through the hype and misinformation about large-screen monitors for desktop publishing. At Moniterm, we developed the first large-screen monochrome monitors. And based on 9 years of OEM experience, we've now built a family of large-screen, hi-res monitors for every application.

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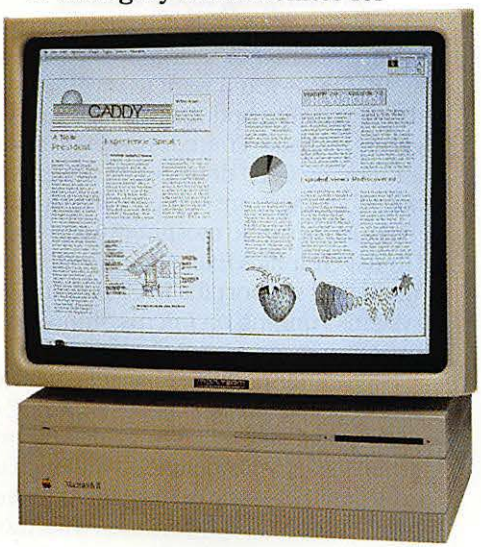
Page-size portrait monitors are great for word processing, but impractical for desktop publishing. To avoid constant zooming and scrolling, we recommend a 19-inch landscape monitor, like our Viking 1 for the Mac SE and Mac II. Professionals who want to view two *full-size* facing pages will need an even larger monitor—our new 24-inch Viking 2400—Moniterm's largest monochrome monitor.

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Optimum publishing resolution for 19-inch or larger monitors is 1280x960 pixels, featured on our Viking 1 and Viking 2400 monitors. At less than 72 dpi (dots per inch), fine print becomes too hard to read. Resolutions more than 95 dpi also make characters hard to read and unfocused. And screen updates are painfully slow.

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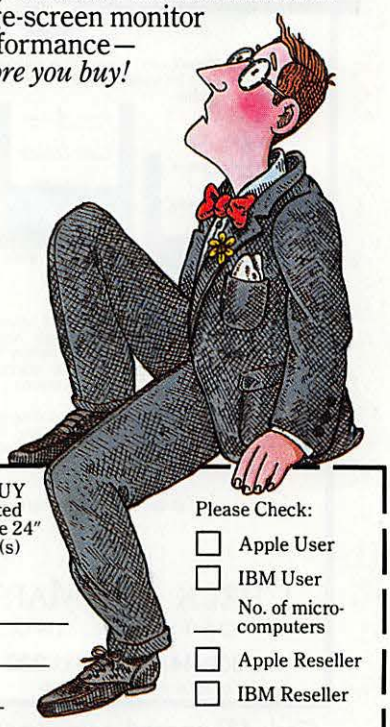
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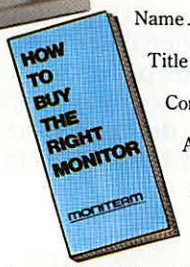
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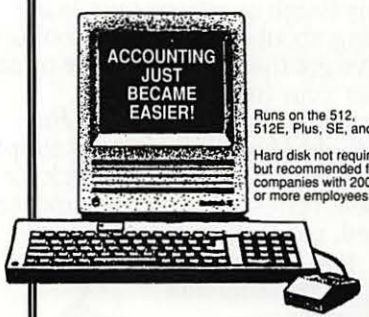
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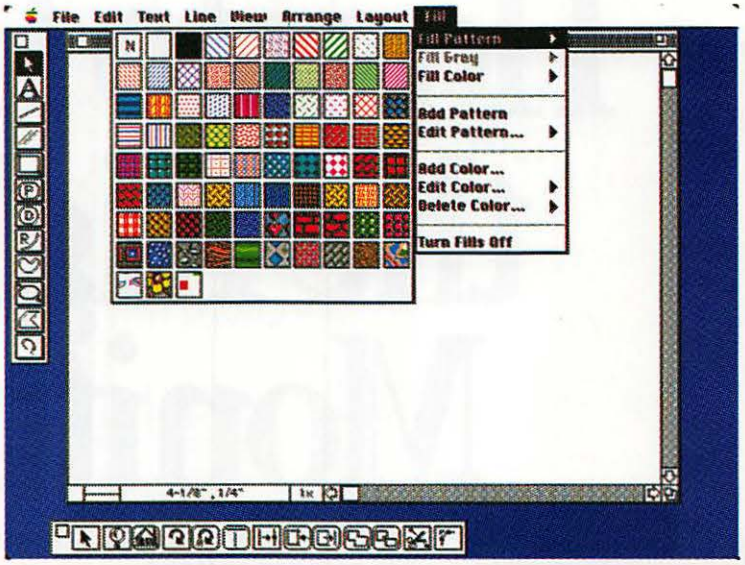
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Exchanging and Printing

If your company already uses a CAD system—whether a large workstation or an IBM PC—you'll want to investigate the data-exchange options that Mac CAD programs provide. There is no single standard for moving CAD drawings between systems, but there are some established formats. Perhaps the most popular is IGES (Initial Graphics Exchange Specification). You'll find support for IGES files in CAD systems running on micros, minis, and mainframes.

Another popular format is the DXF file, popularized by Autodesk's AutoCAD package for IBM PCs. Only one Mac program, VersaCAD, includes a file-exchange program that lets you translate between its own and other CAD formats. With most other CAD programs, file-translation programs cost extra. Kandu Software's CAD Mover is a translation program that translates between IGES, MiniCad, MacDraw, PICT, DXF, and other formats.

A CAD drawing's final destination is a piece of paper, and some CAD programs can get it there in more ways than others can. In the CAD world, the dominant output device isn't a LaserWriter or an ImageWriter, but a *pen plotter,* which prints by zipping special pens across a sheet of paper or mylar film. Most plotters can hold between 4 and 12 different colored pens in a turretlike mechanism, switching between them as instructed by the CAD program. Plotters are often described according to their maximum paper size, with each size labeled by a letter: an *A-size* plotter creates 8½-by-11-inch drawings. *B-size* drawings measure 11 by 17; *C-size,* 17 by 22; *D-size,* 22 by 34; and *E-size,* 34 by 44. Nearly all Mac CAD programs can print to plotters from such industry leaders as CalComp, Hewlett-Packard, Houston Instrument, and Roland.

Plotters take too long to render the subtle serifs and fine details of Mac fonts, so most CAD programs with plotter support include *stroke fonts* for their output. Stroke fonts allow the plotter to draw characters quickly using—you guessed it—single strokes of its pens.

Mac CAD programs also support ImageWriters and LaserWriters, but to varying degrees. Some, such as PEGASYS and Pentagon CAD, print in only low-resolution draft modes. Others, including VersaCAD, MGMStation, PowerDraw, and MiniCad, offer both low- and high-resolution ImageWriter and LaserWriter output. Low-resolution output is useful for producing quick proofs of a drawing. High-resolution requires more time, but takes advantage of a printer's maximum resolution.

CAD's Costs

If you're drooling at the prospect of working CAD into your life, dry up—at least until you check your bank balance. Software with the capabilities I've described doesn't come cheap, and it does come with a voracious appetite for hardware.

Some CAD companies claim their wares run on a 512K, floppy-drive Mac, but the verb *stroll* might be more accurate.

(continues)

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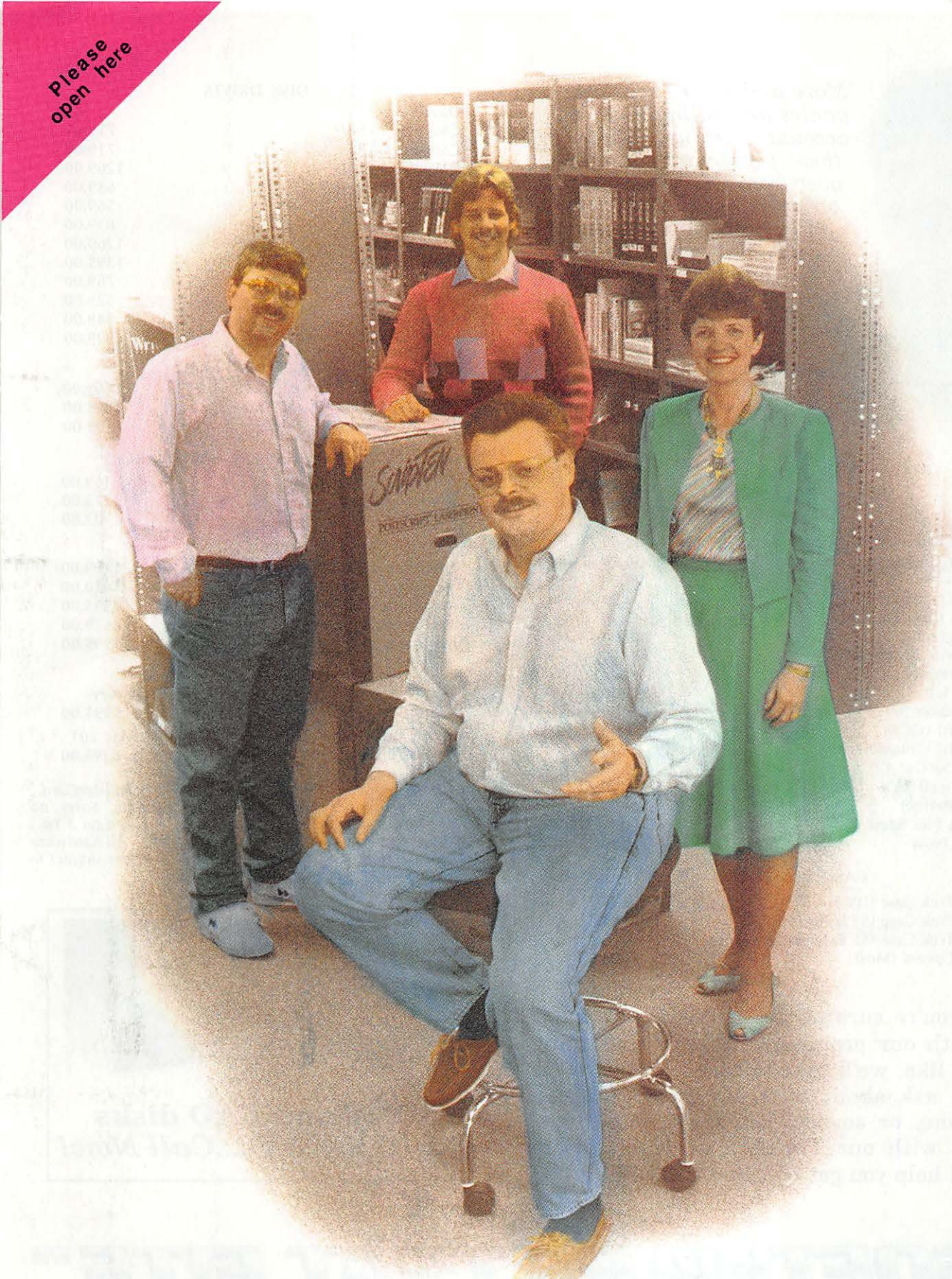
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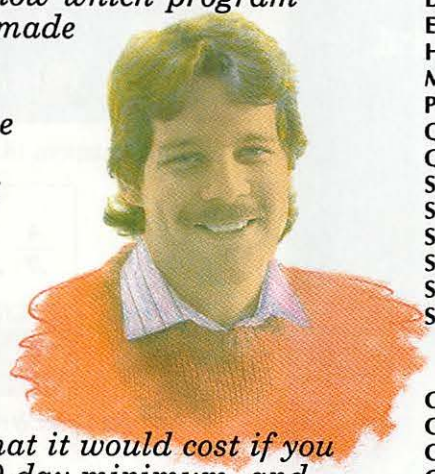


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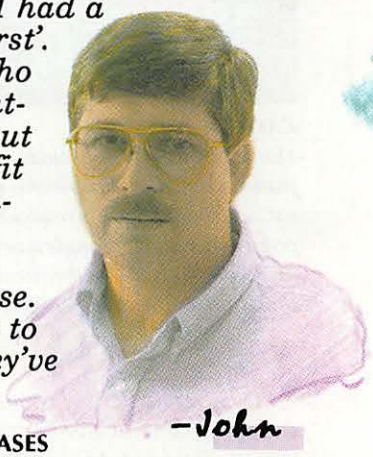
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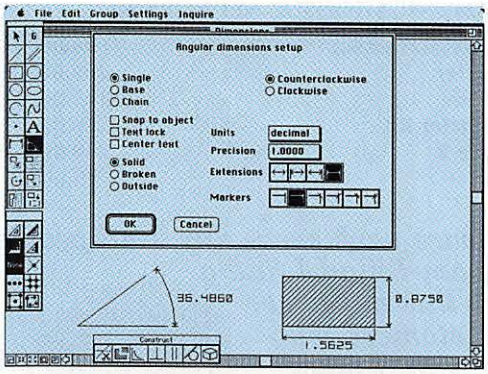
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CAD Dimensions

Most CAD programs provide auto-dimensioning *features that add dimensions to drawings. VersaCAD, shown here, provides* linear *(point-to-point) and* angular *(angle size) dimensioning. The dialog box shows the variations of extension lines and arrows that VersaCAD provides.*

CAD programs crave memory and CAD drawings devour disk space. For serious, day-in, day-out CAD, you need a hard disk and at least a Mac Plus. Best of all is a Mac II or an SE with an accelerator board such as Radius's Accelerator, General Computer's HyperCharger, or Levco's Prodigy SE (see "Beefing Up the SE," *Macworld,* September 1987). If you'd prefer to spend your time drawing rather than scrolling, consider a large-screen monitor. If you use MultiFinder, you may also need a memory upgrade.

Then there's the cost of the programs themselves. VersaCAD tops the list at $1995, with PEGASYS II coming in second at $1795. MGMStation is a more palatable $799; PowerDraw costs $795; and MiniCad, which includes three-dimensional drawing features, goes for $495. Dreams is expected to retail for about $500. But many programs in the under-$1000 ballpark lack the plotter support and file-exchange features included with their high-priced brethren. If you need those features, be sure to tally up the total cost with anv add-on modules before buying.

The most reasonable CAD program is Lionshead Software's Pentagon CAD for $99. Pentagon CAD can't match the talents of a VersaCAD or MGMStation, but it's the most economical way to explore CAD, and it has some powerful mapping features that civil engineers and surveyors may find useful. Generic Software, which makes Generic CAD for the PC, has announced plans to release a Mac version that will cost between $99.95 and $199.95, depending on options.

Where Mac CAD Fits In

Despite the amazing talents of today's CAD programs, the Mac isn't about to send ultra-expensive CAD workstations to the scrapheap. CAD systems exist that can show animated, three-dimensional views of a jetliner in one window, while you zoom in on single rivets in another. Today's Macs lack the processing speed required for such tasks.

Still, Mac CAD programs can lighten the load on those expensive workstations by handling the simpler jobs that can monopolize a workstation's time—freeing it up to do what it does best. As David Peltz says, "I see a lot of Ferraris on the road, but many of them are only doing 55 miles per hour." The Mac may still be only a CAD Chevy, but even a Chevy beats a horse and buggy. □

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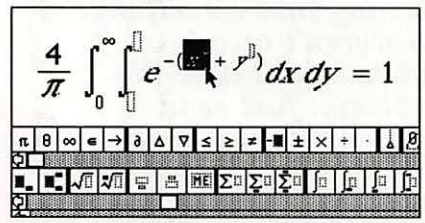
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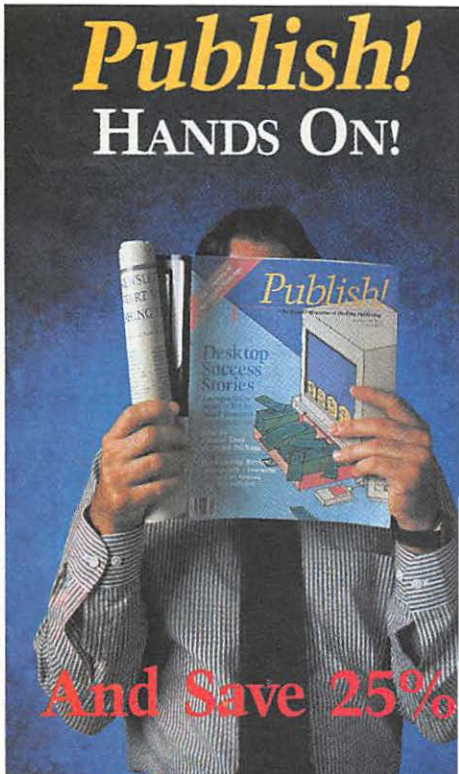
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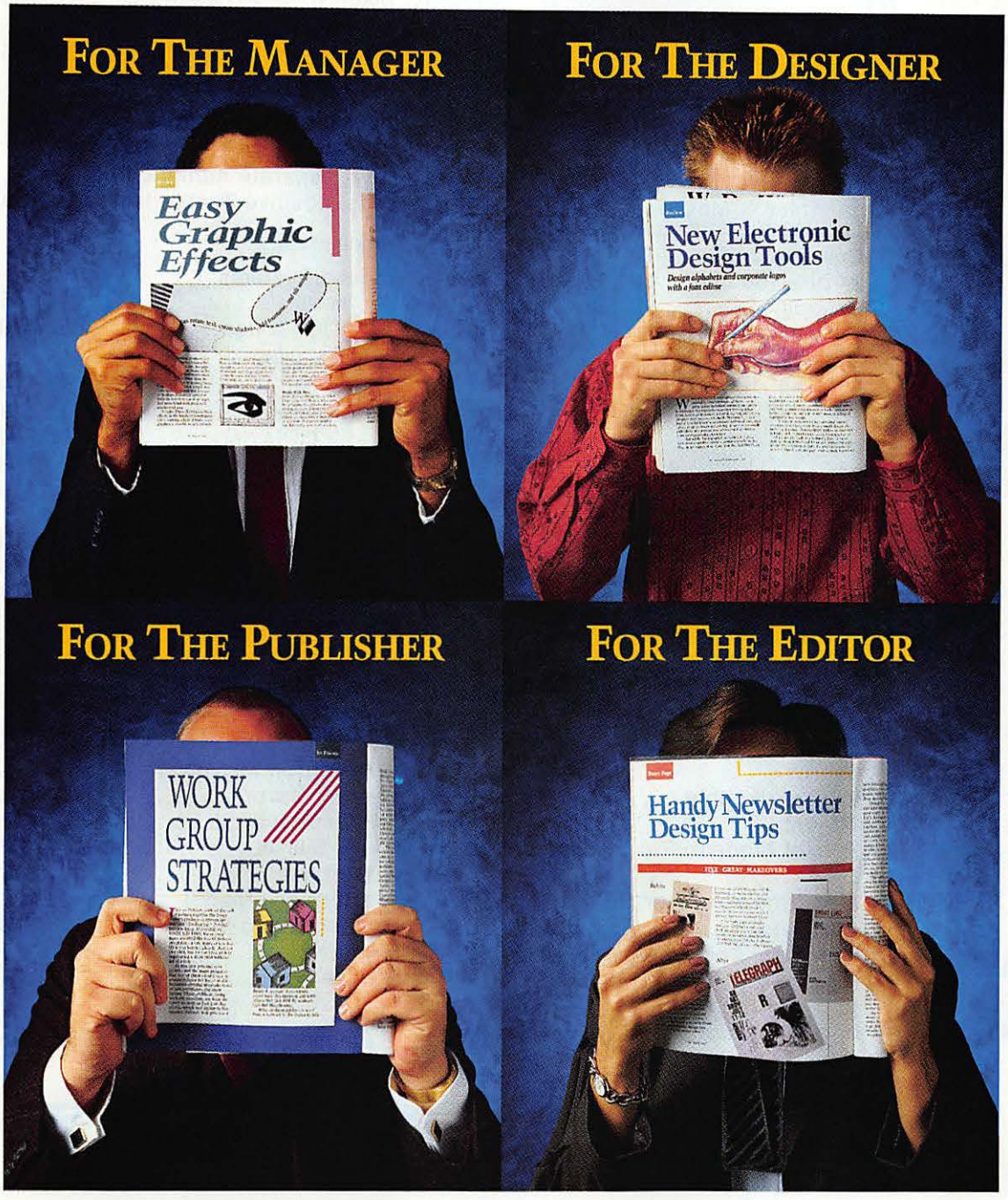
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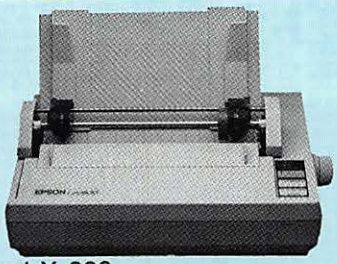
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Insights on MacDraw II

Become a quick-draw artist with tips for the Mac's classic drawing program

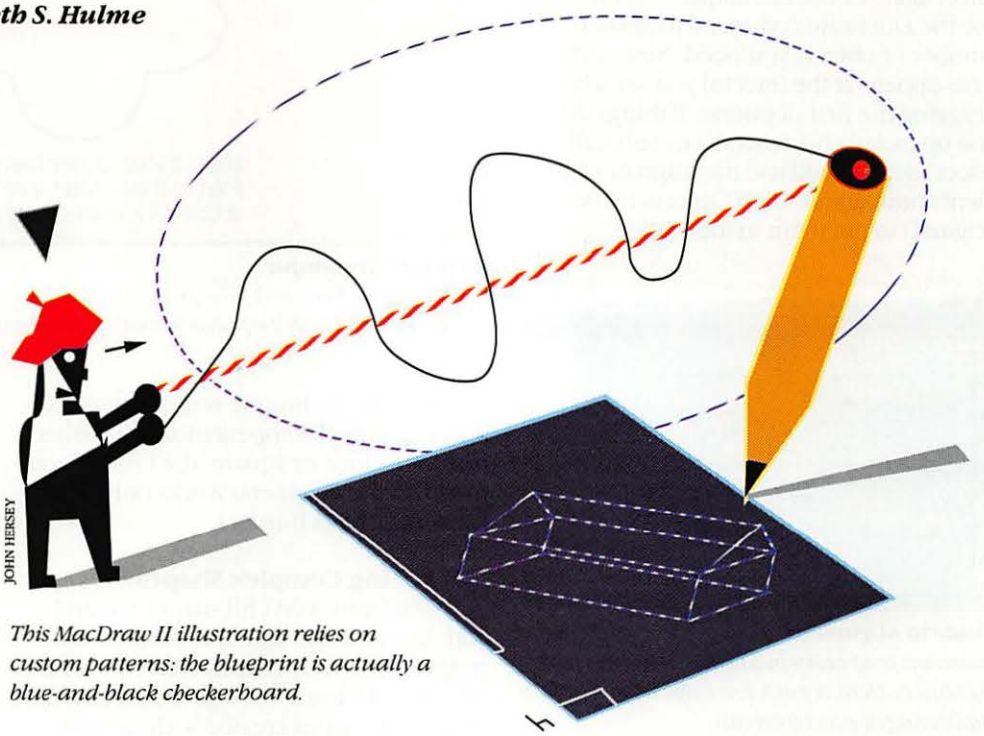
by Kenneth S. Hulme

When Apple introduced MacDraw in mid-1984, it represented a striking alternative to MacPaint's bitmapped graphics. Because MacDraw treats lines, shapes, *and* text as objects, it's a better tool than a bitmap program for mixing text with graphics. MacDraw quickly became a hit with people who pushed it beyond drawing and into the realm of desktop publishing, forms design, and even drafting.

MacDraw II, recently released from Claris Corporation, Apple's software spin-off, offers phenomenally fast screen redraw and dozens of new features, like arbitrary font size selection, customizable arrowheads and line widths, greater text-formatting flexibility, and much more. Though there's decidedly more competition for MacDraw than when it first arrived, its relative ease of use and its value suggest it will continue to have a loyal following.

To coincide with the long-awaited debut of MacDraw II, here's a collection of tips and techniques to speed your work at the electronic drawing board. Many of the tips apply to the old version as well; the tips that work only with the new version refer to the program with its full name—MacDraw II.

You need an original program disk (of any of the previous versions) to obtain a new version for the $100 upgrade fee. For complete details about the MacDraw upgrade, call Claris at 800/544-8554.



This MacDraw II illustration relies on custom patterns: the blueprint is actually a blue-and-black checkerboard.

Working on the Whole Page

In MacDraw you can use all of the tools to create or modify text or objects on *any* view level. That means MacDraw lets you see the whole page and create both text and graphics while in Fit to Window view (Reduce to Fit in original MacDraw). Rough in a drawing at that view so you can see its position on the page, and then zoom in for detail work by choosing a view you've preset or by clicking the Enlarge tool at the bottom of the tool palette (use Normal Size and Enlarge in the original MacDraw). Even on large drawings that span several pages you can work on the whole composition at once.

To zoom in on part of a drawing, select what you want to see up close before you choose a different view; the desired object will then be centered in the new view.

Aligning Objects

Aligning irregular objects or setting an exact amount of space between parts of a drawing can be a real pain. The easy way to do this is to "pencil in" guidelines, as you would on paper at a drawing board.

The best tool for guidelines in MacDraw II is the line tool, constrained by holding down the Shift key to create a horizontal or vertical line parallel to the edge of your drawing (in the original MacDraw, use the plus-shaped tool). With Show Size on and the Autogrid off, you can create lines of exact sizes, to the nearest ten-thousandth of an inch. Guidelines can help you to establish even spacing between lines in a form, to measure along part of an irregular object, or to help line things up wherever necessary (see "Guide to Alignment").

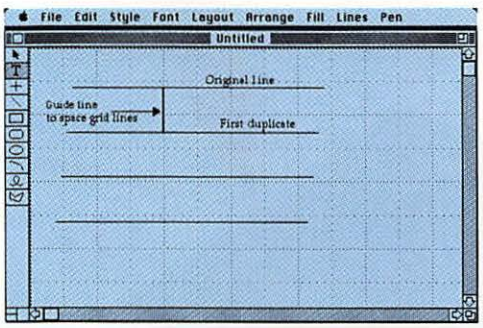
Don't forget to erase guidelines when they're no longer needed—choose a line style that is easy to pick out when you finish a drawing.

(continues)

Ken Hulme teaches Macintosh graphics and desktop publishing at the University of Utah's Computer Center. He uses MacDraw to produce plans for white-water river boats and bonsai trees.

Duplicating at Exact Intervals

MacDraw is wonderful for creating forms, questionnaires, or objects in precise arrays if you know the following trick. Create a master line or object. Then create a guideline that's the length of the spacing you want and butt one end against the master. Select the master and choose the Duplicate command. Drag the duplicated object to the other end of the guideline and position it carefully. With the duplicated object still selected (don't deselect, then select again or the technique won't work), use the Duplicate command to make the number of objects you need. New duplicates appear at the interval you set when dragging the first duplicate. If things don't line up exactly horizontally or vertically, select them all and use the Align or Alignment commands (Align Objects in the original) to put them in their place.



Guide to Alignment

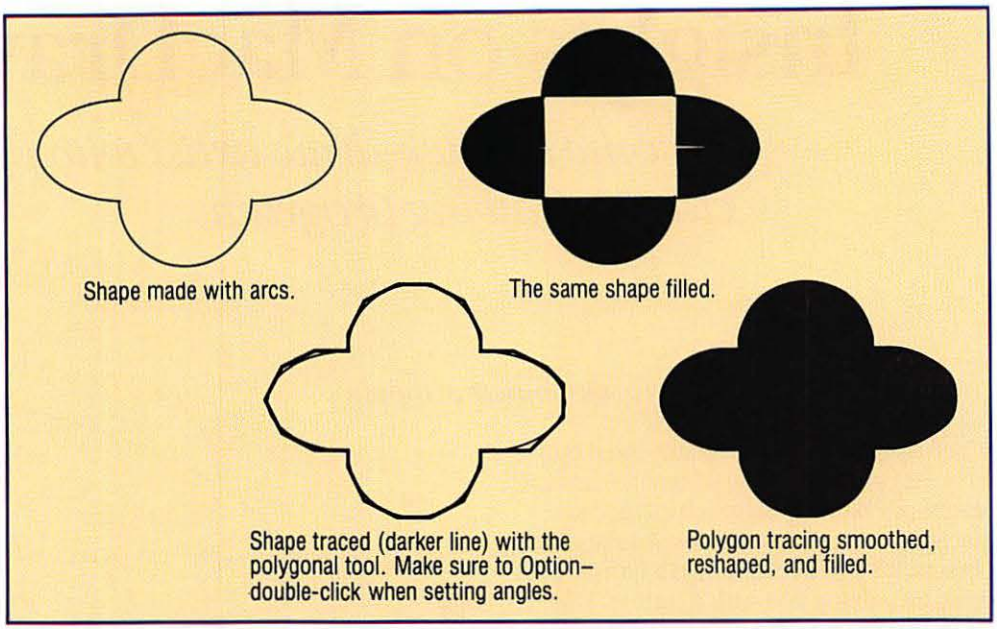
Construct temporary guidelines to aid in aligning objects. Here, a guideline helps set up lines for duplicating at exact intervals.

Patterns

In MacDraw you're stuck with the patterns that the program gives you, but MacDraw II lets you create any pattern you want. Double-click on an existing pattern and a dialog box appears with a pattern editor (see "Custom Patterns"). Modify the pattern, click OK, and the altered pattern appears in place of the original. You can also reorder the pattern bar by selecting a pattern and choosing Move Left or Move Right until the order suits you.

Creating Patterned Lines

In MacDraw II it appears that you can't fill a line or object border with a pattern, as you can in the original version. But you can add a pattern to lines or borders by selecting the object, holding down the Option key, and clicking on a pattern.



A Pattern Technique

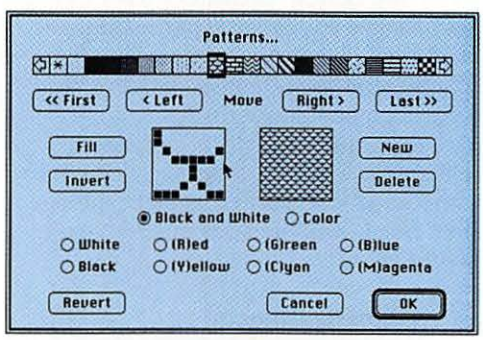
Because you often can't fill a grouped collection of arcs or shapes created with other tools, outline a group of shapes with the polygon tool to create a single object that you can fill.

Use this technique with a striped pattern to create the appearance of a dashed line for a circle or square; the Dashes command on the Pen menu works only with lines, not object borders.

Filling Complex Shapes

MacDraw won't fill shapes created with line and arc segments because the program fills only shapes created with the object tools. Even if you group a collection of lines or shapes created with various tools, the program doesn't view them as an object, and when you try to fill the group you'll probably find patterns where you don't intend them (see "A Pattern Technique").

To fill such a shape, trace it with the polygon tool and then fill the polygon. Judicious use of the Reshape and Smooth commands lets you fine-tune almost any shape. Unfortunately, neither MacDraw nor MacDraw II allows you to fill characters with a pattern.



Custom Patterns

MacDraw II lets you alter its patterns. When you double-click on a pattern, this editing window opens to allow you to change a pattern and change its position on the pattern bar.

Drawing by Polygon

The polygon tool is the single most useful tool in either version of MacDraw. Every time you click while using the polygon tool, you create a handle that you can grab to manipulate the shape. The more often you click, the more handles you can manipulate. Use the tool to rough in complex shapes, then select Reshape to fine-tune the object. For objects that need true curves, choose Smooth on the Edit menu to convert the curves you approximated with the polygon tool into actual bezier curves—then Reshape. The handles now allow you to change the shape of the curves.

Reshaping Polygons

In MacDraw II, you can easily add or subtract handles to reshape objects created with the pencil or polygon tool. Select an object, choose the Reshape function, then hold down the Option key and click on a point to remove it. Click instead on the line itself to add a point.

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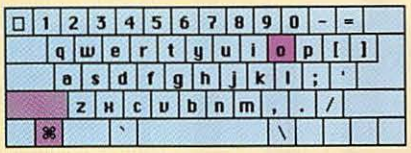
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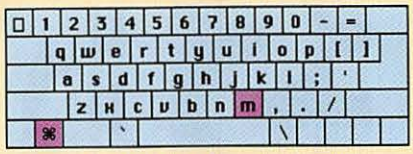
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MacDraw II Shortcut Key

Selected keyboard shortcuts, at a glance



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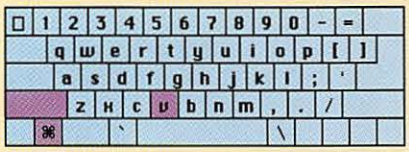
Fit to Window: ⌘-M



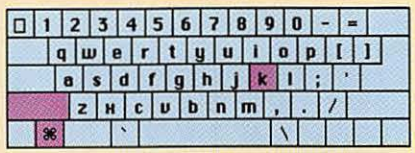
Save As: ⌘-Shift-S



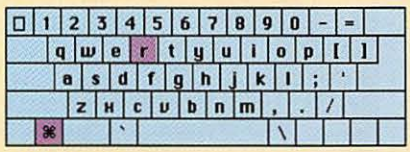
Select a View (by preset view number): ⌘-1 through ⌘-9



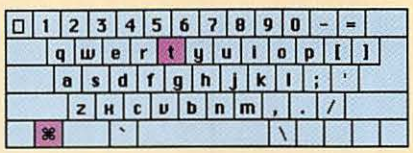
Rescale when pasting: ⌘-Shift-V



Alignment: ⌘-Shift-K



Reshape: ⌘-R



Rotate: ⌘-T



Smooth: ⌘-E



Group: ⌘-G



Unsmooth: ⌘-Shift-E



Ungroup: ⌘-Shift-G

Improved Visibility with Polygons

In MacDraw II, if you press down the Option key and mouse button together as you draw a polygon segment, the segment remains invisible until you release the mouse. That way you see the underlying drawing clearly as you move the cross-hair cursor around to position the next handle.

Shift-⌘ Key

MacDraw II adds a number of ⌘-key equivalents not found in the original. Many functions, such as Ungroup and Unlock, are performed by using Shift-⌘ sequences (see "MacDraw II Shortcut Key").

Mixing Type Styles

MacDraw artists often mix text and graphics in a project. Many times you want to change the style of a word or two in the middle of plain text, but the original MacDraw allows you to type only one text style in a paragraph. In MacDraw II, you can select some text and then change its style, but for subscripts and superscripts you have to use the somewhat laborious method developed to mix styles in the original MacDraw.

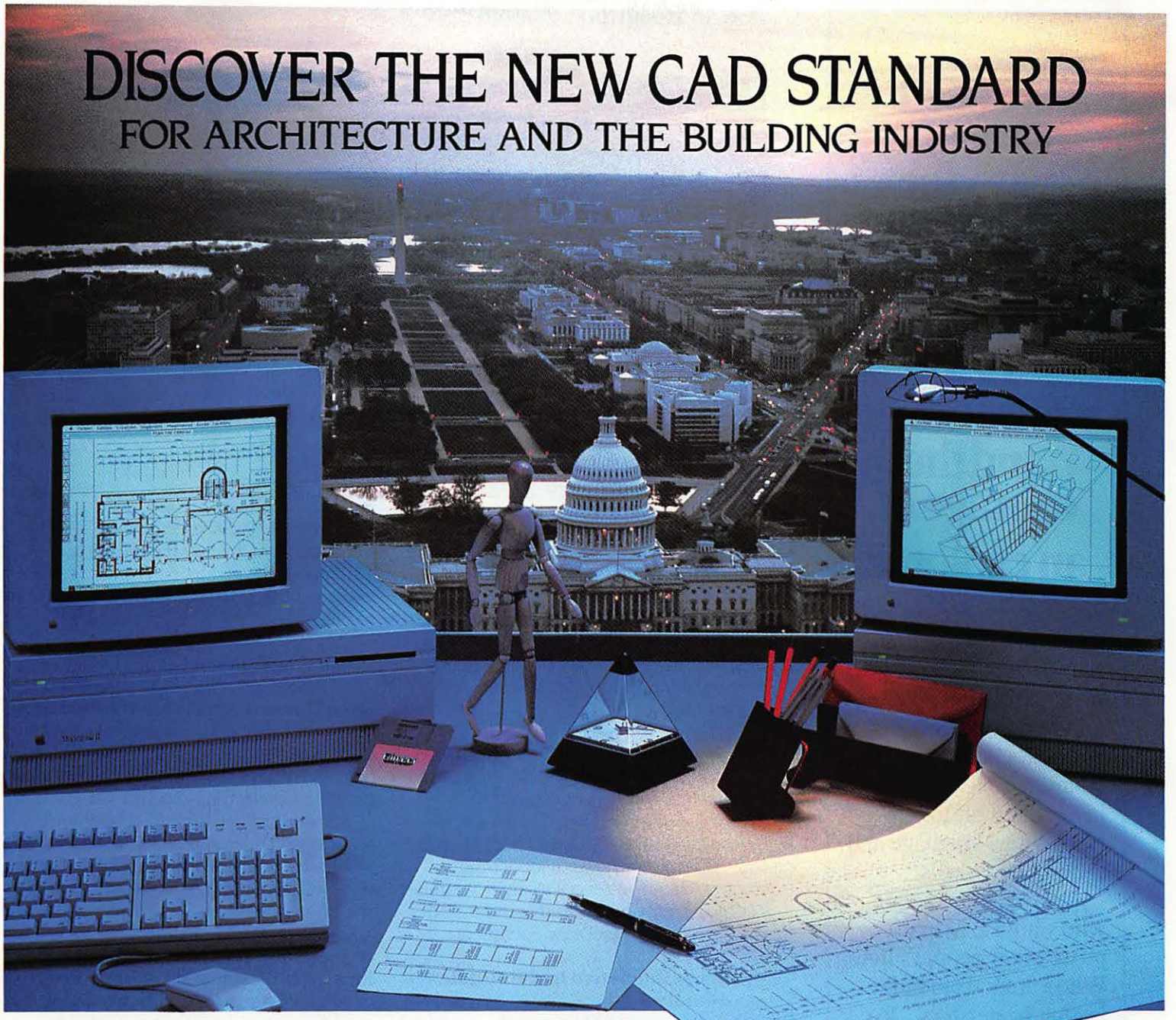
Start by making a space for the specially formatted text; leave extra blank spaces for each letter because bold and italic characters are wider than plain text (for subscripts and superscripts choose a size or two smaller than the main text). Go somewhere else on the document and type the special characters in the style you want. Create a guideline at the baseline of the plain text, spanning the gap you left for the special characters. Drag the special text to the space and position it by lining it up with the guideline. Tweak the spacing, if necessary, and erase the guideline. Select the main text, shift-click to select the stylized bit, and then use Group to hold them together.

White Type

Though you can't shade characters in MacDraw, you can make reversed type —white (or in MacDraw II, a contrasting color) lettering against a shaded background. Type the text and choose Outline style. With the text block selected, choose the background pattern you want; the text appears as white letters against the background. For maximum legibility, choose a serif font with wide strokes, such as Bookman.

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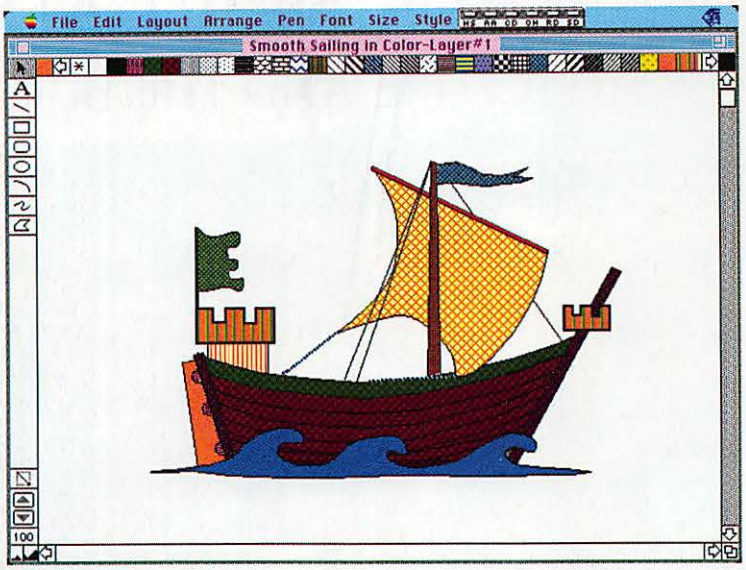
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Smooth Sailing in Color
This sketch of a 14th-century Hansa cargo ship uses both custom-designed patterns and standard patterns that have been "colorized."

Reselecting the Last-Used Tool

MacPaint artists who try MacDraw are often frustrated at first because after they use a tool, it automatically reverts to the pointer. To circumvent this in the original MacDraw, you'd hold down the ⌘ key and draw again. In MacDraw II, double-click when selecting a tool to draw with it continuously.

Saving Steps with Drawing Tools

When you choose a tool, set its attributes—line width, Pen, Fill, and so on—*before* you start drawing if you want the custom attributes to stay in effect for every tool. This method saves a lot of time and trouble when you set out to draw a number of objects with attributes that differ from the defaults of a MacDraw document.

What Happened to the Middle Handles?

In the original MacDraw, if you wanted to lengthen a rectangle, you clicked on the middle handle of the top, bottom, or side edge and then dragged in the direction you wanted. MacDraw II shapes lack the middle handles. In MacDraw II, you hold down the Shift key and grab any corner handle of an object; then drag it to widen or lengthen the shape.

Scaling Objects Proportionally

Shrinking or enlarging an object to a particular size is easy. Make a duplicate of the object, so that if you goof you won't mess up the original. Turn on Show Size and select the copy. Hold the pointer down on one of the corner handles to see the horizontal and vertical dimensions of the object. Then drag the corner handle to resize; when the size bar shows the dimensions you want, release the mouse button. Text grouped with an object doesn't scale with the object, so you'll have to resize text separately.

Saving Custom Setups

Preferences, tool settings, font and line definitions, and other attributes are *document specific* in MacDraw II, but you can create Stationery to save unusual settings for specific tasks: create a blank document with the settings you want and save it as Stationery. Then instead of opening the program to create a drawing, open the Stationery file to get an Untitled document complete with those settings.

A New World of Color

MacDraw II lets you create and define color patterns; you won't see them on screen unless you have a color monitor, but even if you don't you can print color images on an ImageWriter II with color ribbons. To keep both color and standard black-and-white patterns available, add colored versions to the pattern bar. Start by double-clicking a pattern to reach the pattern editor, and then choose New. This creates a duplicate of the pattern, which you can color and otherwise modify. If you plan to do a lot of color work, take the time to create a full palette of colored patterns and save the blank document as Stationery (see "Smooth Sailing in Color"). Then, when you need to create a color drawing, just rip off a piece of the color stationery and start drawing, modifying the colored patterns as necessary. □

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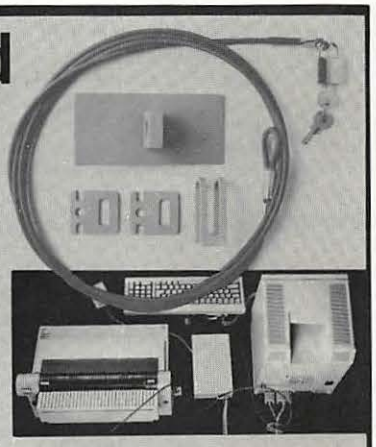
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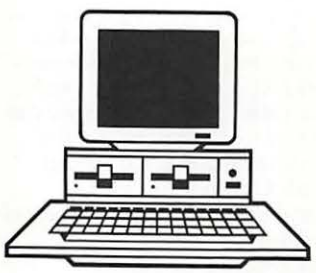
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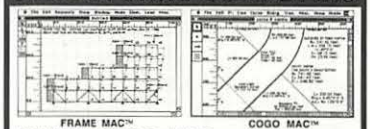
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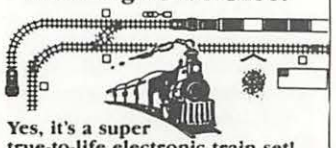
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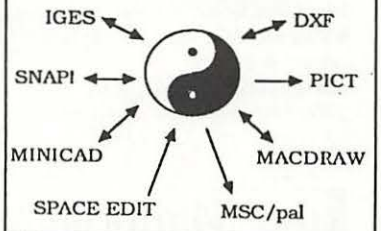
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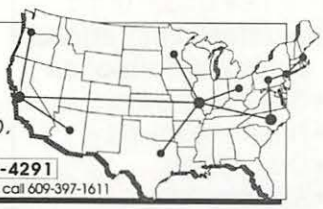
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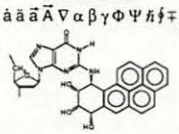
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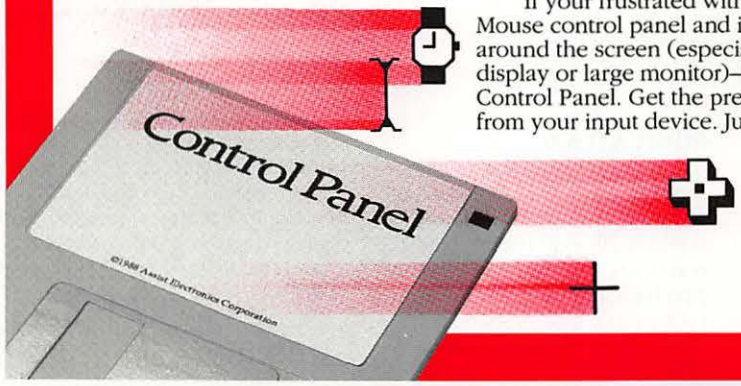
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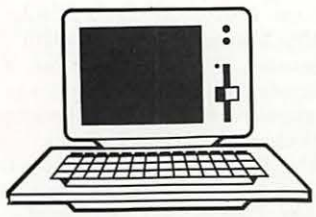
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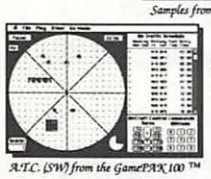
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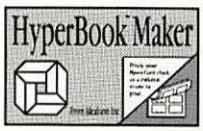
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Updates

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Design/OA version 2.15 has over 50 new interface routines, a User Data Library, and an ASCII Database Library. Supports construction, display, manipulation, and analysis of diagrams. Meta Software Corp., 150 CambridgePark Dr., Cambridge, MA 02140, 617/576-6920. Free; $5000 new.

Dial-in Network Access version 1.3 offers Chooser access for password security, as well as greater flexibility in remote connection setup. Improves compatibility with Microcom, Hayes, and Telebit high-speed modems. Shiva Corp., 222 Third St., #1200, Cambridge, MA 02142, 617/661-2026. Dial-in Network Access upgrade alone is free; complete NetSerial upgrade, including hardware, password security, new Dialer, and NetSerial software $50; NetSerial hardware and software $399 new.

Expressionist version 2.0 includes presettable default fonts and palette symbols, two-way TeX interface, auto-baseline (only with WriteNow 2.0), and improved graphics. Allan Bonadio Associates, 814 Castro St., San Francisco, CA 94114, 415/282-5864. $29.95 with return of original disks; $129.95 new.

Icon-It version 1.1 allows you to design custom icon bars and open two icon bars simultaneously. Maps icons to the function keys of the Apple extended keyboard and includes more templates. MultiFinder compatible. Olduvai Corp., 6900 Mentone, Coral Gables, FL 33146, 305/665-4665. Free with return of disk, otherwise $10; $79.95 new.

MacSmarts version 3 uses HyperCard as a front end and adds seamless integration with HyperCard stacks. Cognition Technology Corp., 55 Wheeler St., Cambridge, MA 02138, 617/492-0246. $25; $195 new.

MacTran Plus version 3.0 has an integrated environment, an intelligent symbolic debugger, and language extensions for handling large code and data sizes. Supports the Mac II, color, MultiFinder, and inline code generation for the 68020/68881. DCM Data Products, 1710 Two Tandy Center, Fort Worth, TX 76102, 817/870-2202. $99; $399 new. Educational discounts available.

Market Master for the Macintosh version II increases speed. Offers an automated search feature and automatic file updating. Market Master with results analysis (R/A) also available. Breakthrough Productions, 10659 Caminito Cascara, San Diego, CA 92108, 619/281-

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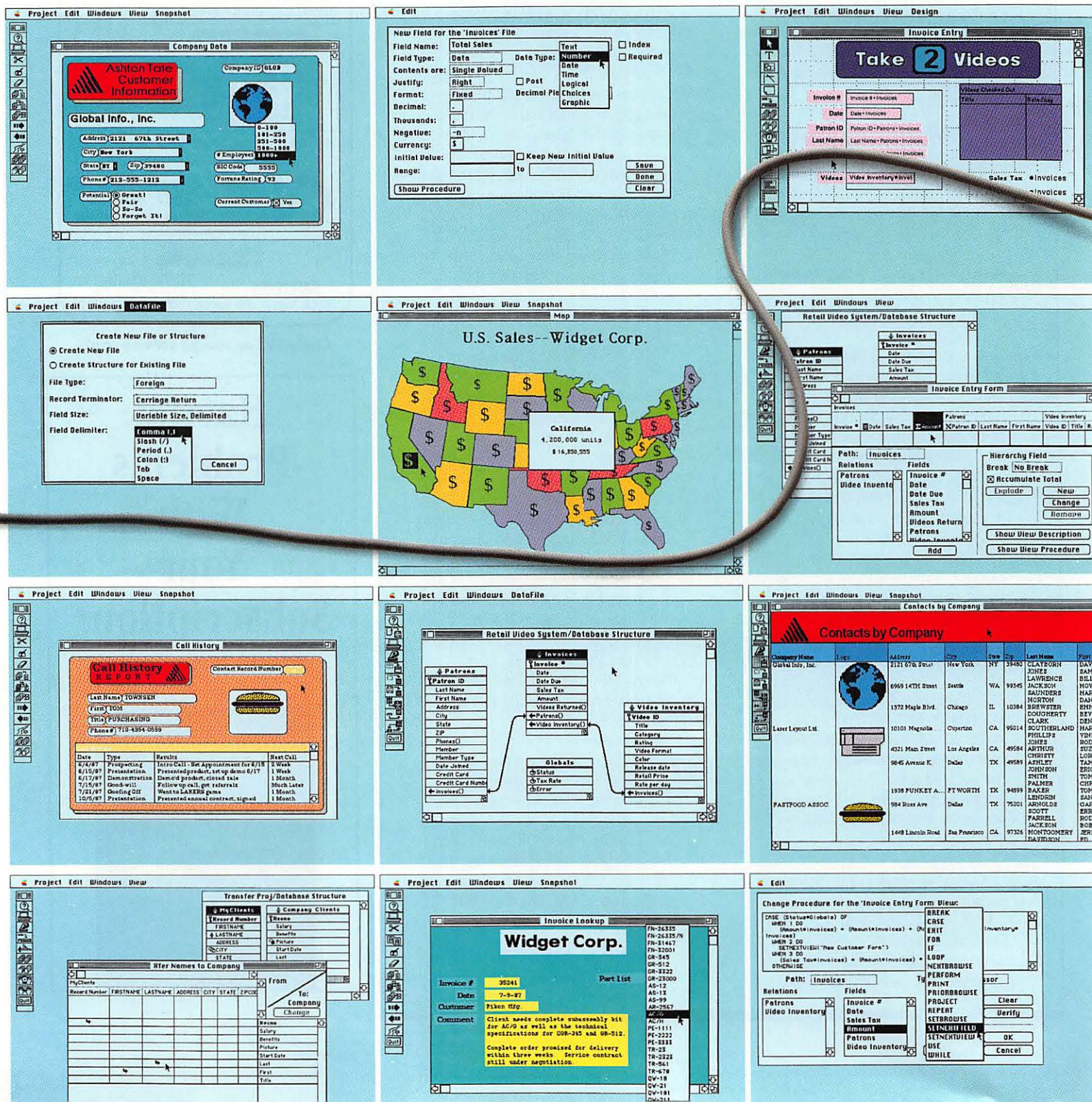
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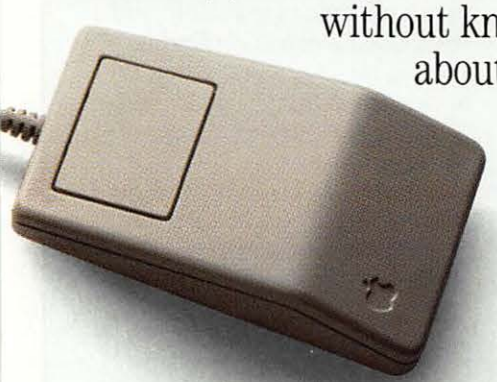


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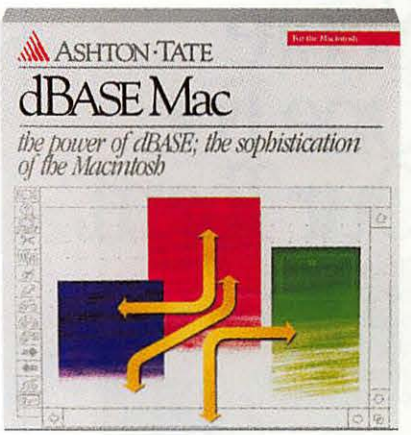
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6174. Market Master version II $20, Market Master R/A $100; Market Master version II $295, Market Master R/A $395 new.

MathType version 1.53 improves spacing and fixes bugs. Design Science, Inc., 6475-B E. Pacific Coast Hwy., #392, Long Beach, CA 90803, 213/433-0685. Free if upgrading from 1.50 or 1.51, otherwise $15; $149 new.

MicroPhone II is fully compatible with MultiFinder. Enhances communications performance. Supports Cut, Copy, Paste, Quit, and other menu commands in scripts, and can map them to the keyboard. Allows import and export of scripts as text files. Supports KERMIT, including remote server commands. Supports Ymodem batch and Ymodem-G. Offers modem drivers for complete control of Hayes, non-Hayes, and PBXs. Supports extended keyboard; screen buffer command; Copy Table, Append to File, and Launch; variables and an expression analyzer for string/arithmetic manipulations. Allows you to change baud rates and all other settings in scripts. Allows screen addressing in scripts. Enhances VT100 emulation. Supports host printing commands. Software Ventures Corp., 2907 Claremont Ave., #220, Berkeley, CA 94705, 415/644-3232. $50; $295 new.

Professional Composer version 2.2 corrects playback speed. The Cancel button in the small dialog box that is present during printing now functions. You can specify page range when printing. Beams are thicker. Dots on whole notes and semibreves are spaced correctly. Arrow keys on Mac Plus, SE, and II now function. Several problems with printing parts have been fixed. Check Range functions correctly. Measure numbers at beginning of systems will be correct even if starting measure isn't numbered 1. Endings draw to the end of the bar. After selecting a document and printing from the Finder, you return to the Finder. The intermittent crash when deleting staves no longer occurs. Mark of the Unicorn, Inc., 222 Third St., Cambridge, MA 02142, 617/576-2760. Free; $495 new.

QT Backup Software version 1.02 provides Apple read-write compatibility, multiple tape backup, and a PowerTag file selection feature. Tecmar, Inc., 6225 Cochran Rd., Solon, OH 44139-3377, 216/349-0600. Free; $1395 new.

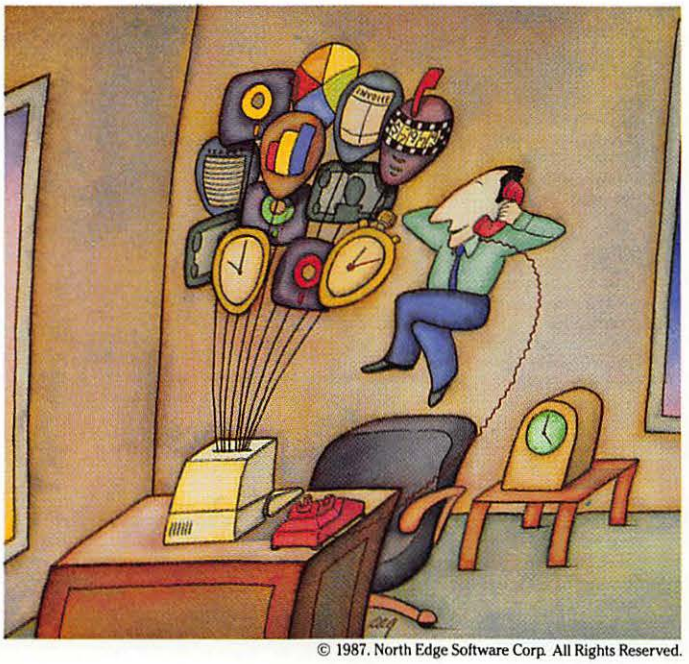
Roundup version 2.0 adds ReadySetGo version 4.0 files. It also runs in the background under MultiFinder. Virginia Systems Software Services, Inc., 5509 West Bay Ct., Midlothian, VA 23112, 804/739-3200. $10; $49.95 new.

V.I.P. version 2.5 includes C language translators that extend HyperCard by automatically producing external commands. Mainstay, 5311-B Derry Ave., Agoura Hills, CA 91301, 818/991-6540. $30; $149.95 new. □

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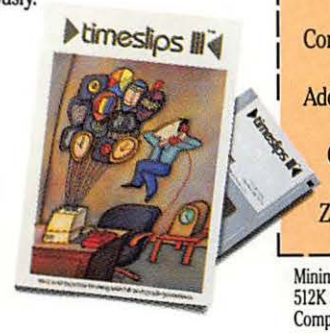
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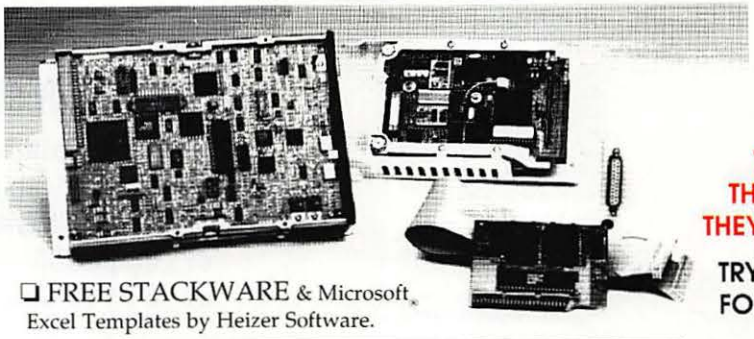
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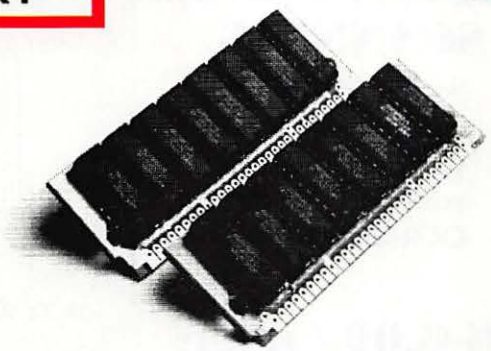


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703 **AnyGraph.** Compatible Systems Corp., P.O. Drawer 17220, Boulder, CO 80308, 303/444-9532, 800/356-0283.
704 **AnyPC.** Compatible Systems Corp., P.O. Drawer 17220, Boulder, CO 80308, 303/444-9532, 800/356-0283.
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713 **Business LaserPrinter Upgrade.** General Computer Corp., 580 Winter St., Waltham, MA 02154, 617/890-0880, 800/634-9737.

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714 **Calculus.** Sensei Software, published by Brøderbund Software, Inc., 17 Paul Dr., San Rafael, CA 94903-2101, 415/492-3200.
715 **Chameleon.** Spectrum Computing, Inc., P.O. Box 141097, Coral Gables, FL 33114, 305/665-0404.
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718 **Color Space II.** Mass Micro Systems, Inc., 550 Del Rey Ave., Sunnyvale, CA 94068-3528, 408/522-1200, 800/522-7979.
719 **Conrac Model 7250/7351.** Conrac Corp. Displays Products Group, 1724 S. Mountain Ave., Duarte, CA 91010, 818/303-0095.

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723 **Electrohome ECM 1900 Series.** Electrohome, Ltd., Display Systems, 809 Wellington St., Kitchener, Ontario, Canada N2G 4J6, 519/744-7111.

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725 **Generic CAD.** Generic Software, 8763 148th Ave. NE, Redmond, WA 98052, 206/885-5307.

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727 **JamBox Series.** Southworth Music Systems, Inc., 91 Ann Lee Rd., Harvard, MA 01451, 617/772-9471.
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735	**MacAstrologer.** Full Phase Software, P.O. Box 17045, Seattle, WA 98107, 206/325-2113.
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744	**MacProject II.** Claris Corp., 440 Clyde Ave., Mountain View, CA 94040, 415/962-8946 (product information), 800/544-8554 (upgrade information), 800/334-3535 (dealer information).
745	**MacProof 3.0.** ALP Systems, Inc., 295 Chipeta Way, Salt Lake City, UT 84108, 801/584-3050, 800/354-5656.
746	**MacTablet.** Summagraphics Corp., 777 Commerce Dr., Fairfield, CT 06430, 203/384-1344, 800/243-9388.
747	**MacViewFrame.** nView Corp., 11835 Canon Blvd., #C-101, Newport News, VA 23606, 804/873-1354.
748	**MacWrite.** Claris Corp., 440 Clyde Ave., Mountain View, CA 94040, 415/962-8946 (product information), 800/544-8554 (upgrade information), 800/334-3535 (dealer information).
*	**Magic 020.** MacProducts USA, 9709 Brown Ln., Ste. E, Austin, TX 78754, 512/832-0335, 800/622-3475.
749	**McSink.** Signature Software, 2151 Brown Ave., Bensalem, PA 19020, 215/639-8764.
750	**MGMStation CAD/CAM.** Micro CAD/CAM, Inc., 5900 Sepulveda Blvd., Van Nuys, CA 91411, 818/376-0008.
751	**Microphone II.** Software Ventures Corp., 2907 Claremont Ave., #220, Berkeley, CA 94705, 415/644-3232.
752	**Microsoft Excel.** Microsoft Corp., 16011 N.E. 36th Way, Box 97017, Redmond, WA 98073-9717, 206/882-8080, 800/426-9400.
753	**Microsoft Word.** Microsoft Corp., 16011 N.E. 36th Way, Box 97017, Redmond, WA 98073-9717, 206/882-8080, 800/426-9400.

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755 **MIDIface II.** Austin Development, 227 Marin St., San Rafael, CA 94901, 415/454-9620.
756 **MiniCAD.** Diehl Graphsoft, 8370 Court Ave., #202, Ellicott City, MD 21043, 301/461-9488.
757 **Mitsubishi FHF 3500.** Mitsubishi Electronics America, Inc., 991 Knox St., Torrance, CA 90502, 213/515-3993.

N

758 **Nanao FLEXSCAN 8060S.** Nanao USA Corp., 23510 Telo Ave., #5, Torrance, CA 90505, 213/325-5202.
759 **NuVision.** Perceptics, Inc., P.O. Box 22991, Knoxville, TN 37933, 615/966-9200.

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760 **Passport MIDI Interface.** Passport Designs, Inc., 625 Miramontes St., Half Moon Bay, CA 94109, 415/726-0280.
761 **PC Viewer PCV 6448AV.** In Focus Systems, Inc., 7649 S.W. Mohawk St., Tualatin, OR 97062, 503/692-4968, 800/327-7231.
* **PCPC HD-20 WSI.** Personal Computer Peripherals Corp., 4710 Eisenhower Blvd., Bldg. A, Tampa, FL 33634, 813/884-3092, 800/622-2888.
* **PCPC II Graphics System.** Personal Computer Peripherals Corp., 4710 Eisenhower Blvd., Bldg. A, Tampa, FL 33634, 813/884-3092, 800/622-2888.
762 **PEGASYS II.** IGC Technology Corp., 305 Lennon Ln., Walnut Creek, CA 94598, 415/945-7300.
* **Planit.** CompServeCo, 800 Freedom, Slidell, LA 70458, 504/649-0484, 800/272-5535.
763 **PowerDraw.** The Computer Shoppe, P.O. Box 18344, Greensboro, NC 27419, 919/299-4843.
* **Prodigy 4.** Levco, 6160 Lusk Blvd., #C-203, San Diego, CA 92121, 619/457-2011.
764 **Professional Plus.** Opcode Systems, Inc., 1024 Hamilton Ct., Menlo Park, CA 94025, 415/321-8977.
765 **ProViz.** Pixelogic, Inc., 800 W. Cummings Park, #2900, Woburn, MA 01801, 617/938-7711.

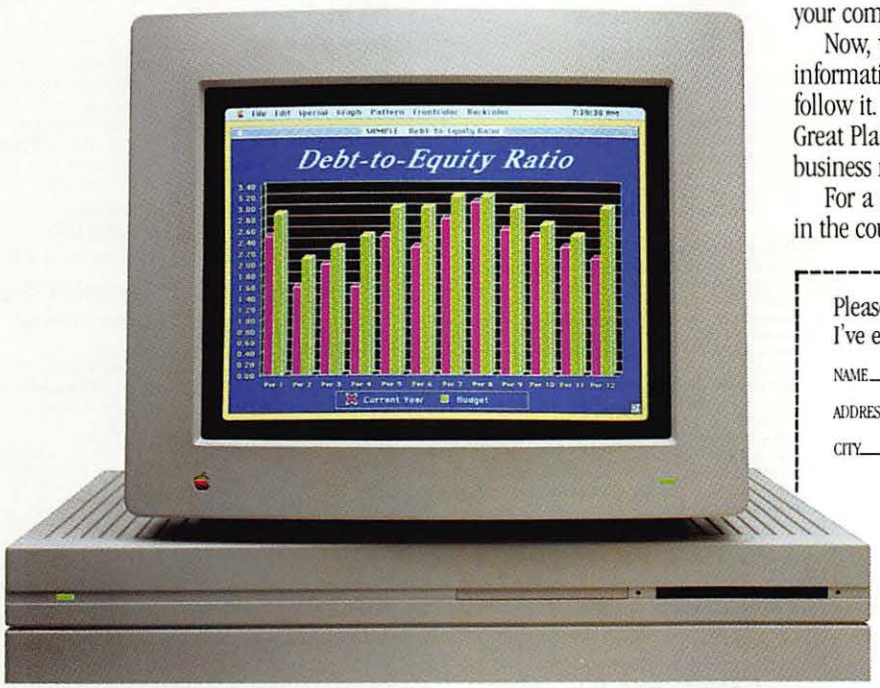
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766 **QuickCapture.** Data Translation, Inc., 100 Locke Dr., Marlboro, MA 01752, 617/481-3700.
767 **QuickShare.** Compatible Systems Corp., P.O. Drawer 17220, Boulder, CO 80308, 303/444-9532, 800/356-0283.

R

768 **Radius Accelerator 16.** Radius, Inc., 404 E. Plumeria Dr., San Jose, CA 95134, 408/434-1010,
769 **Radius Two Page Display.** Radius, Inc., 404 E. Plumeria Dr., San Jose, CA 95134, 408/434-1010.
770 **RasterOps ColorBoard 104.** RasterOps Corp., 10161 Bubb Rd., Cupertino, CA 95014, 408/446-4090.
771 **RasterOps ColorBoard 64.** RasterOps Corp., 10161 Bubb Rd., Cupertino, CA 95014, 408/446-4090.
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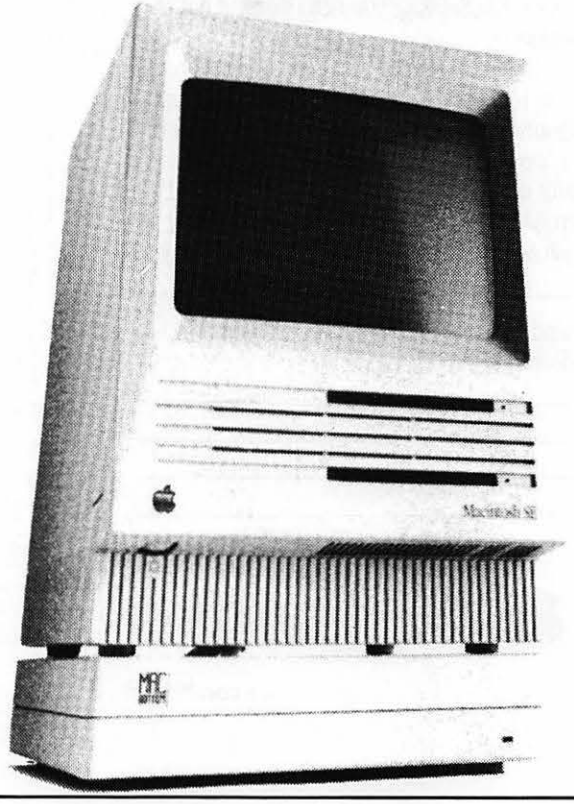
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773 **Sensible Grammar 1.1a.** Sensible Software, Inc., 335 E. Big Beaver, #207, Troy, MI 48083, 313/528-1950.
774 **Smartcom II.** Hayes Microcomputer Products, Inc., P.O. Box 105203, Atlanta, GA 30348, 404/441-1617.
775 **Sony GDM-1602.** Sony Corp. of America, 1 Sony Dr., Park Ridge, NJ 07656, 800/222-7669.
776 **Sony GDM-1952.** Sony Corp. of America, 1 Sony Dr., Park Ridge, NJ 07656, 800/222-7669.
777 **SpaceEdit.** Abvent, Inc., 23331 El Toro Rd., #209, El Toro, CA 92630, 714/380-0333.
778 **Spectrum/8 Video Board.** SuperMac Technology, 295 N. Bernardo Ave., Mountain View, CA 94043, 415/964-8884.
779 **Studio Plus Two.** Opcode Systems, Inc., 1024 Hamilton Ct., Menlo Park, CA 94025, 415/321-8977.
780 **Super 3D.** Silicon Beach Software, Inc., P.O. Box 261430, San Diego, CA 92126, 619/695-6956.

(T)

781 **Taxan MultiVision 770 Plus.** Taxan USA Corp., 18005 Courtney Ct., City of Industry, CA 91748, 818/810-1291.
782 **Timecode Machine.** Opcode Systems, Inc., 1024 Hamilton Ct., Menlo Park, CA 94025, 415/321-8977.
783 **TOPS.** TOPS, A Sun Microsystems Co., 950 Marina Village Pkwy., Alameda, CA 94501, 415/769-9669, 800/445-8677.
* **TrueVision NuVista VideoGraphics Adaptor.** TrueVision, Inc., 7351 Shadeland Station, #100, Indianapolis, IN 46256, 317/841-0332, 800/858-8783.
784 **TSI-020.** Total Systems Integration, 99 W. Tenth Ave., #333, Eugene, OR 97401, 503/345-7395, 800/874-2288.

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785 **Ultrasync.** Princeton Graphics Systems, 601 Ewing St., Bldg. A, Princeton, NJ 08540, 609/683-1660, 800/221-1490.
* **UnWS.** Public domain software.

(V)

786 **VersaCAD/Macintosh Edition.** VersaCAD Corp., 2124 Main St., Huntington Beach, CA 92648, 714/960-7720.
787 **Video JamBox.** Southworth Music Systems, Inc., 91 Ann Lee Rd., Harvard, MA 01451, 617/772-9471.
788 **WordPerfect 1.0.** WordPerfect Corp., 288 W. Center St., Orem, UT 84057, 801/225-5000, 800/321-4566.

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Months on chart	Last month	This month	
18	3	1	**Microsoft Works** *Microsoft*
38	2	2	**Microsoft Word** *Microsoft*
30	1	3	**Microsoft Excel** *Microsoft*
26	4	4	**PageMaker** *Aldus*
16	5	5	**MacWrite** *Claris*
31	–	6	**MacDraw** *Claris*
4	–	7	**FileMaker Plus** *Nashoba Systems*
2	6	8	**Quark XPress** *Quark*
4	7	9	**WordFinder** *Microlytics*
16	8	10	**SuperPaint** *Silicon Beach Software*

Education Software

Months on chart	Last month	This month	
22	1	1	**Math Blaster** *Davidson & Associates*
6	2	2	**Reader Rabbit** *The Learning Company*
22	3	3	**KidsTime** *Great Wave Software*
19	–	4	**Typing Tutor III** *Simon & Schuster Computer Software*
11	5	5	**Early Games** *Springboard Software*

Entertainment Software

Months on chart	Last month	This month	
18	4	1	**Dark Castle** *Silicon Beach Software*
22	1	2	**Flight Simulator** *Microsoft*
22	2	3	**MacGolf** *Practical Computer Applications*
2	3	4	**Beyond Dark Castle** *Silicon Beach Software*
4	5	5	**Falcon** *Spectrum Holobyte*

Networking/Data Communications

Months on chart	Last month	This month	
18	1	1	**TOPS** *TOPS*
14	2	2	**AppleShare** *Apple Computer*
22	3	3	**LocalTalk (formerly AppleTalk)** *Apple Computer*
9	4	4	**PhoneNet** *Farallon Computing*
20	–	5	**MacServe** *Infosphere*

Hard Disks*

Months on chart	Last month	This month	
11	1	1	**Macintosh Internal 20SC Hard Disk** *Apple Computer*
18	2	2	**Apple Hard Disk 20/20SC** *Apple Computer*
3	3	3	**Macintosh Internal 40SC Hard Disk** *Apple Computer*
11	4	4	**Rodime 20 Plus** *Rodime*
2	–	5	**Compact SC 40** *CMS Enhancements*

Add-in Boards

Months on chart	Last month	This month	
9	4	1	**Radius Accelerator** *Radius*
9	1	2	**Apple 2MB Memory Expansion Kit** *Apple Computer*
9	2	3	**Apple 1MB Memory Expansion Kit** *Apple Computer*
5	3	4	**Macintosh II Video Card** *Apple Computer*
5	–	5	**MacSnap Plus 2** *Dove Computer*

Product Watch

Editors' choice:
Other recent products of particular interest.

Dreams *Innovative Data Design* 2-D color computer-aided-design software

FoxBase+/Mac *Fox Software* relational database manager compatible with dBase II and dBase III Plus

SuperPaint 2.0 *Silicon Beach Software* color paint/draw program

Source: Exclusive InfoCorp survey of more than 125 Macintosh retailers and selected mail-order suppliers. Covers sales during April 1988.

** Does not include hard disks installed at the factory.*

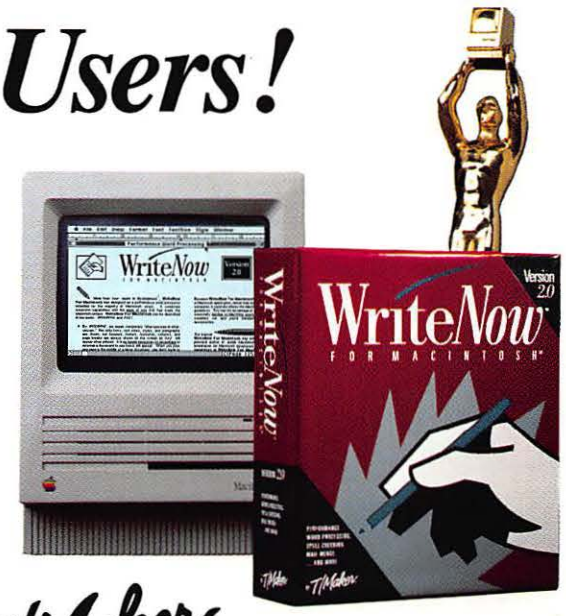
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Maximum recommended document size (in pages)	Over 2,000	240	50	500
Number of open documents	Unlimited *	1	30	30
Mail merge	**Yes**	No	No	Yes
Number of editable, on-screen columns (WYSIWYG)	4	1	1	1
On-screen auto-numbering footnotes	Yes	No	No	No
Automatic repagination	Yes	Yes	No	No
Graphics in same line as text	Yes	No	Yes	Yes
Multiple headers and footers	Yes	No	No	Yes
Extensive Undo	Yes	No	No	No
Variable line spacing (in points)	Yes	No	No	Yes
Selective font, size, style, and ruler changes	Yes	No	No	Yes
MacUser Magazine's Best New Word Processor	**Yes**	No	No	No
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Copy & Paste large area	6.8 *sec*	1 *min* 0.9 *sec*	12.4 *sec*	12.3 *sec*
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All timing tests performed by an independent testing organization on a 12-page document using a Macintosh SE and a 20 megabyte hard disk.

* **Number determined by Macintosh system constraints.**

Demo version of WriteNow included on all Jasmine hard drives.

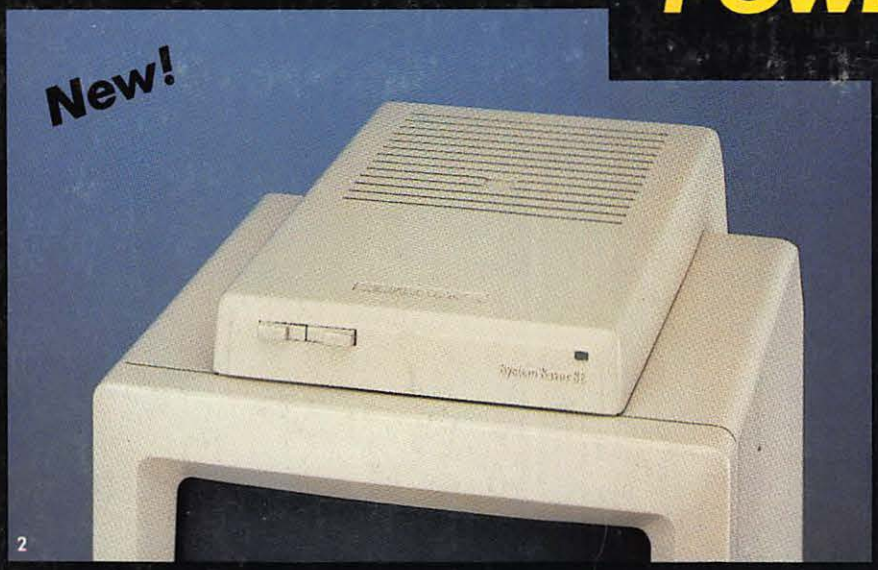
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Circle 332 on reader service card



He had a reputation as a power user. But deep down he knew it wasn't true. Oh, he had the software alright. But the real power, the electrical power that ran his Mac was another story. He lived in fear of its surges and spikes. He lacked the proper outlets. He knew he was out of control...

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1. **Master Piece® Mac II** starts with five protected outlets. Added modem surge suppression protects against surges and spikes on the phone line. And a built-in swivel lets you adjust your monitor. $159.95

2. **System Saver® SE** offers two protected outlets and a replacement for your SE's power cord, a choice of 1 or 2 switches, and modem/phone line surge suppression. $79.95

3. **System Saver Mac** not only gets your power under control, it keeps your Mac or Mac Plus cool. Two protected outlets, a replacement power cord, a quiet fan, and a choice of 1 or 2 switches. $99.95

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See Us at Macworld Expo, Bayside #1636

Circle 11 on reader service card